Biological Assessment of Potential Effects to Threatened and Endangered Salmon and Steelhead Species from Construction of Pasco Pump Lateral 5.8 in Franklin County, Washington

Prepared For

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Purpose

This biological assessment (BA) describes and analyzes the effects of the Bureau of Reclamation's proposal to construct Pasco Pump Lateral Wasteway 5.8 as well as for the future operation of the wasteway on listed species and their critical habitat.

Introduction

Reclamation and South Columbia Basin Irrigation District (SCBID) propose to construct a new pipeline and wasteway for the Columbia Basin Project (CBP) system that will allow return flow to directly enter the Columbia River.

The CBP is one of the largest agricultural irrigation projects in the western United States, encompassing about 3,900 square miles of a semiarid plateau located in the central part of the State of Washington within portions of Grant, Lincoln, Adams, Franklin, and Walla Walla counties. The CBP lands stretch from Franklin D. Roosevelt Reservoir behind Grand Coulee Dam in the north, from which it receives Columbia River water, southward across the Columbia Plateau to Pasco, Washington at the confluence of the Columbia and Snake Rivers.

Reclamation operates and maintains all of the CBP's major facilities. The Quincy-Columbia Basin Irrigation District, East Columbia Basin Irrigation District, and South Columbia Basin Irrigation District (SCBID) operate and maintain all of the irrigation distribution facilities within their geographic areas. Land use is predominantly irrigated agriculture, dryland agriculture, confined animal feeding operations, and rangeland operations.

The CBP was authorized for the irrigation of 1,029,000 acres. Currently, approximately 671,000 acres (557,530 acres of platted farm units, 73,227 acres of water service contracts, 40,323 acres of Quincy sub-groundwater license) are served by the CBP. Most development occurred in the 1950s and 1960s with acreage added sporadically through the mid-1980s. In addition to supplying water for irrigation, producing electricity, controlling floods, providing recreation, and regulating streamflow, the CBP also provides water for cities, industries, navigation, and endangered species.

The water in the CBP canal system is gravity fed in a southerly direction and has over 300 miles of main canals, 2,000 miles of laterals, and 3,500 miles of drains and wasteways. Multiple return flows enter the Columbia River at locations starting west of Quincy, Washington and extending downstream to Pasco, Washington.

Project Description

Location

The project area is in Franklin County directly across the Columbia River from Richland, Washington (Figure 1). The center of Pasco, Washington, lies about five miles to the southeast of the project area. The outlet of the new PPL 5.8WWwill be at river mile 339.5 on the left bank of the river (Figure 1). The completed PPL 5.8 pipeline will measure about 1.25 miles long, and it will flow west from its point of origin near the intersection of Dent Road and Richview Drive. The route lies in the right-of way (R/W) of existing roads and canals or pipelines for most of its length along Dent Road. After about two-thirds of a mile, the route of the PPL 5.8 pipeline leaves the side of Dent Road passes onto private lands as it makes its way westward toward the Columbia River. Just before reaching the Columbia River, about 1.25 miles from its start, the PPL 5.8 pipeline would pass through a strip of land owned by the United States and managed by the Corps' Walla District (Figure 2). This biological assessment will only assess effects of the construction of the outlet and the operation of the PPL 5.8WW. All other aspects of the construction of the PPL 5.8 pipeline have been determined to have no effect on listed species or their critical habitat due to the distance from the Columbia River.

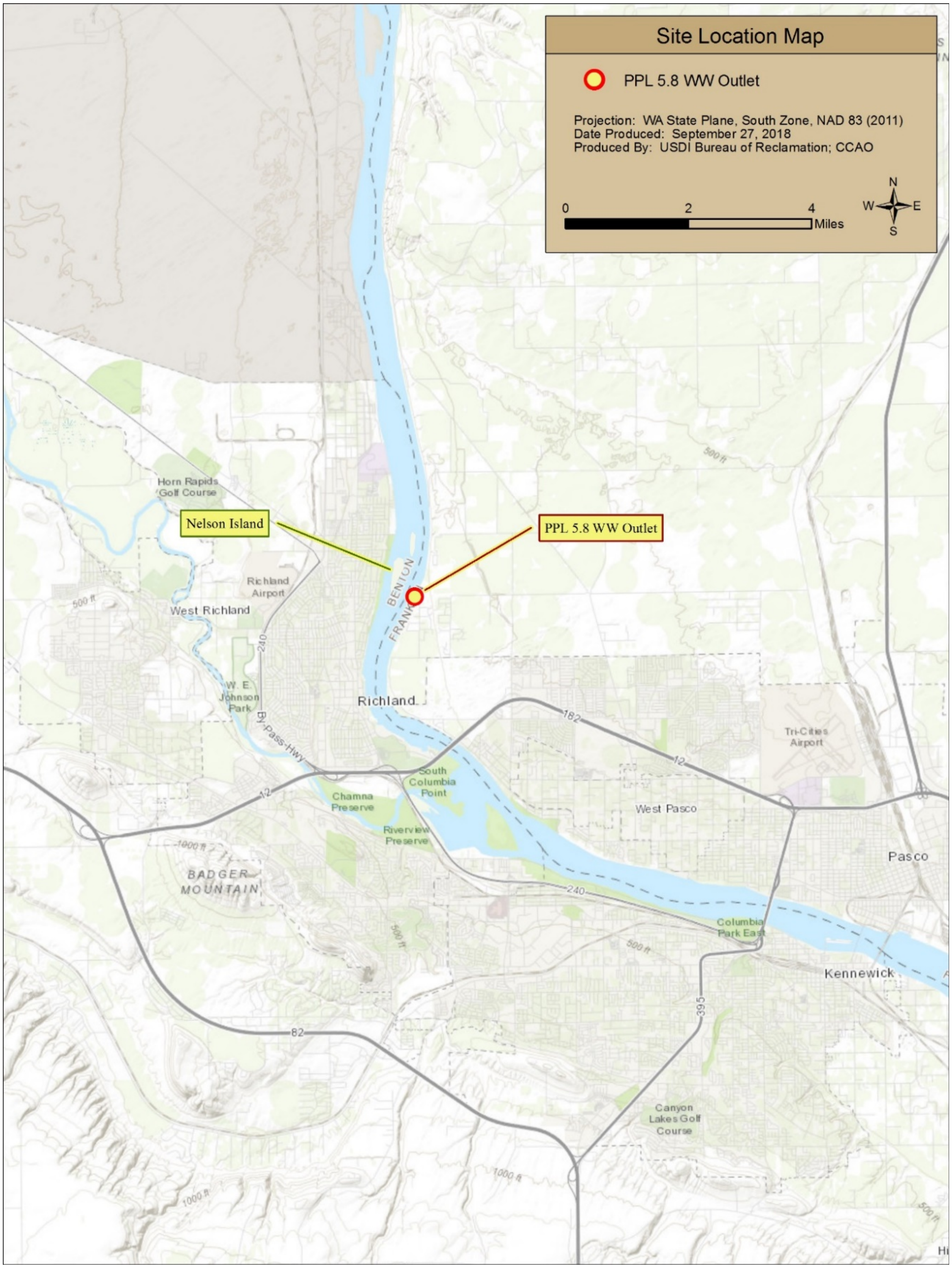

Figure 1. Vicinity map showing the PPL 5.8 WW site.

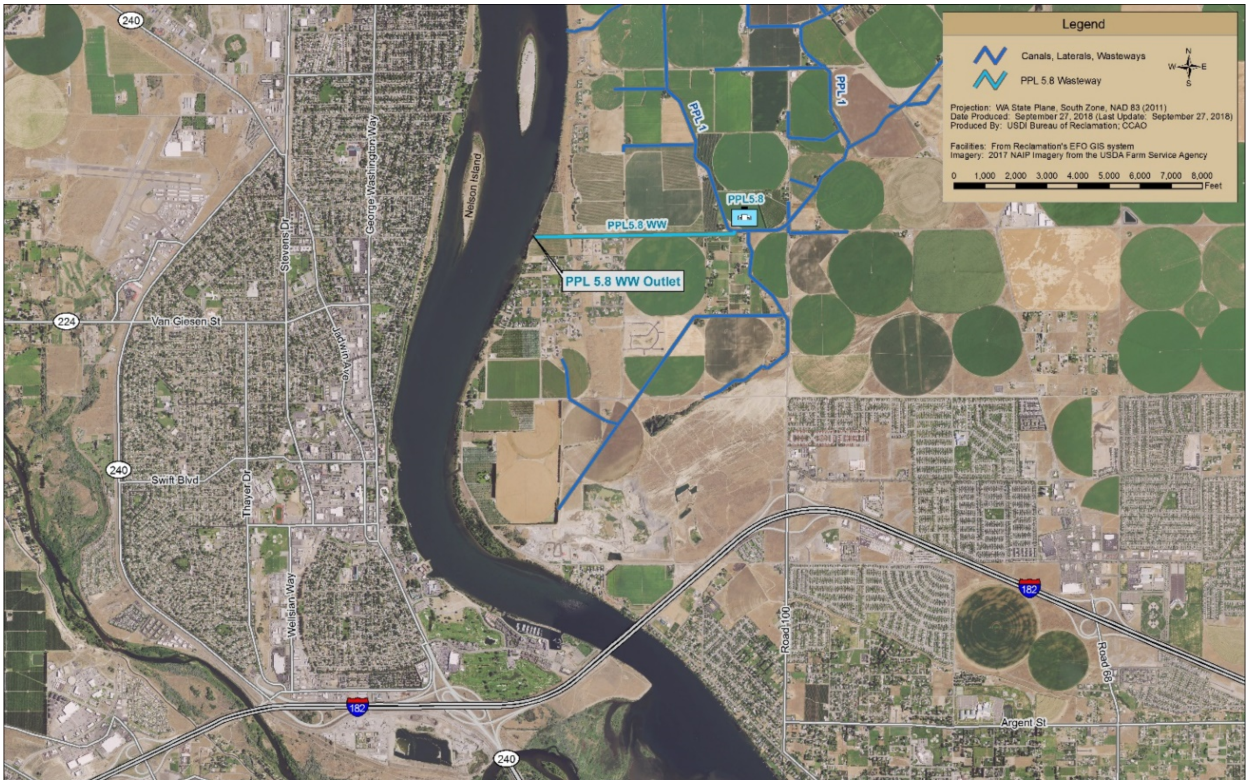

Figure 2. **Map showing the pipeline and PPL 5.8WW alignment.**

Proposed Action

The proposal is to modify the existing PPL Canal by constructing the PPL 5.8WW to allow excess irrigation water to directly flow into the Columbia River. The PPL 5.8WW will provide a primary point of protection for the canal system between the PPL 4.3 Check Structure and the PPL 6.2 pumping plant (PPL 6.2 PP) in the event of outages, eliminating the need to spill wastewater (excess irrigation water) onto private property.

Currently, water flows via the PPL 6.0 WW into privately owned Adams Pond. Given the rapid urban development in the area and potential for future flooding, Reclamation and SCBID need an alternative operation by which water can be wasted in the event of an emergency shutdown of PPL 6.2WW. Currently during an emergency shutdown, water will back-up in the PPL system and into the PPL 6.0 Lateral, PPL 6.0WW and, ultimately, Adams pond. Without an available and extended PPL 6.0WW operation, water upstream with no other immediate outlet or return capability to the Columbia River will result in failure of the PPL. Water in Adams Pond eventually infiltrates into the ground water and returns to the Columbia. Adams Pond does not hold water year round.

Proposed project timing for the construction of the PPL 5.8 WW (outlet and flume) is November 1 through February 28 of 2019-2021, which is the time when no adult salmonids are observed in the action area and few juvenile salmonids are anticipated to be present.

Baffled Outlet and Flume

The baffled outlet structure and flume is a reinforced concrete structure, located at the terminal end of the pipeline. It is located at the shoreline of the Columbia River, where it forms Lake Wallula.

The baffled outlet structure is formed from a headwall, sill wall, sidewalls, slab, and deck (Figure 3). Inside the structure, a reinforced concrete baffle is placed immediately downstream of the pipe exit location. Flows exiting the pipe impact the concrete baffle, dissipating flow energy. The downstream sill wall creates a stilling basin pool which further dissipates flow energy. This structure will have metal grating over the top to prevent fall hazards and public access. This structure will be located approximately 42.5 feet back from the riverbank at the upstream face of the headwall, and extend for approximately 8-9 feet. This structure will be directly connected to the flume section located downstream. Excavation for this structure is anticipated to occur following construction of the flume section, using standard construction methods. The entirety of this structure lies above the OWHM defined for this project, which is at elevation 342.38’ in the NAVD88 datum.

The excavation will utilize sloped embankments, which may or may not occur simultaneously with the pipe trench construction. It is anticipated that some local dewatering may be required in this area to remove groundwater present at the invert of the excavation. This water would be routed back uphill, along the alignment, to flow overland back to the river. Once the structure is constructed, had the metal grating installed and has reached strength, it could be backfilled with soil.

The flume section consists of a reinforced concrete slab, slightly wider than the side retaining walls. The side walls are parallel, and extend from the baffled outlet structure to the riverbank. At the downstream end, two 6’ wide retaining walls extend from the flume to retain the near-vertical embankment around the structure at the riverbank. A 1’ long by 1’ tall reinforced concrete strut brace will span between the downstream flume walls, set flush with the top of walls. This brace is required to maintain the structural integrity of the flume walls, and resist the outside soil loadings present at this site. All of the walls will extend to approximately 6 inches above existing ground surface. The inside of the flume will be finished concrete. The top of the structure will have metal grating with support beams to prevent fall hazards and limit public access to the facility. At least one section of the grating will be hinged to permit O&M access to the flume for regular cleanout. Design measures were employed, including a sloping high-velocity slab and a 4’ vertical sill wall at the downstream end of the baffled outlet structure to prevent fish stranding or entrainment in this basin, which would then necessitate fish salvage operations. Flows which exit the baffled outlet structure will flow over the weir and into the flume, where they will be routed to the Columbia River down a sloping concrete slab. At the end of the slab, flows could either spill off of the slab and down into the river, or flow directly into the river, depending upon the river depth present during the flow event. Flow depth at this location is controlled by the U.S. Army Corps of Engineers (USACE), based upon operations at McNary Dam downstream and to a lesser extent by releases at Priest Rapids Dam upstream.

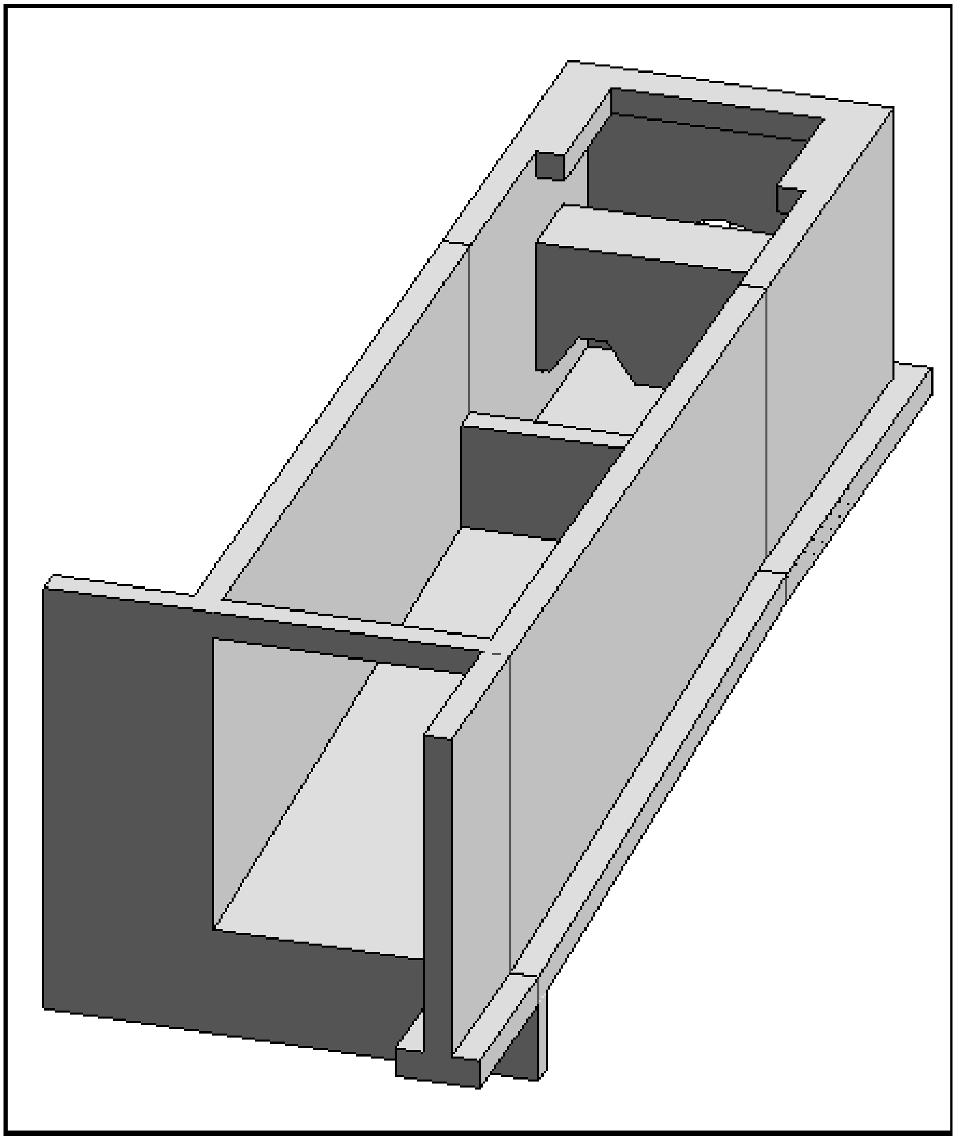

Figure 3. 3-D isometric of the baffled outlet structure, showing the view from above.

Work area isolation methods will be determined by Lake Wallula water elevation. If there are sufficient water levels, a debris boom and turbidity curtain will be installed to isolate the effects of the construction. This system is required to prevent vegetation and sediment from falling into the Columbia River and being swept downstream off the project site. The site will be seined to herd fish out of the area before the debris boom and turbidity curtain are put in place. The system will be installed at the riverbank, extending out into the river channel.

Once the anchorages are set, the contractor would use an excavator or small mobile crane to lift the floating debris boom and turbidity curtain system over the vegetation and into the water. Once placed, it would be secured to the anchorages, and set to protect the river environment against sediment. Once installed, the turbidity curtain and debris boom would permit clearing and grubbing operations.

If lake elevations are low, and there is sufficient land access available, straw bales and silt fence could be placed instead of the turbidity curtain and debris boom. These bales and silt fence would be secured using wooden stakes to prevent movement. Following this step, the clearing and grubbing operation would commence, with the trees and vegetation being felled into the space created by the straw bales and silt fence. Once the clearing and grubbing was complete, the vegetation would be removed by hand labor or small equipment (Bobcat/Skidsteer).

Figure 4. Site conditions in September 2018.

It is likely that Lake Wallula will be low enough to use the hay bale system. A field visit by SCBID Engineer in September 18, 2018 show exposed substrate below the project site (Figure 4). Water elevations are expected to stay at or near these elevations through the work window (Figure 5). If similar site conditions are present during construction of the outlet and flume, it is not expected that fish will be present. However, the site will be assessed and seined if needed.

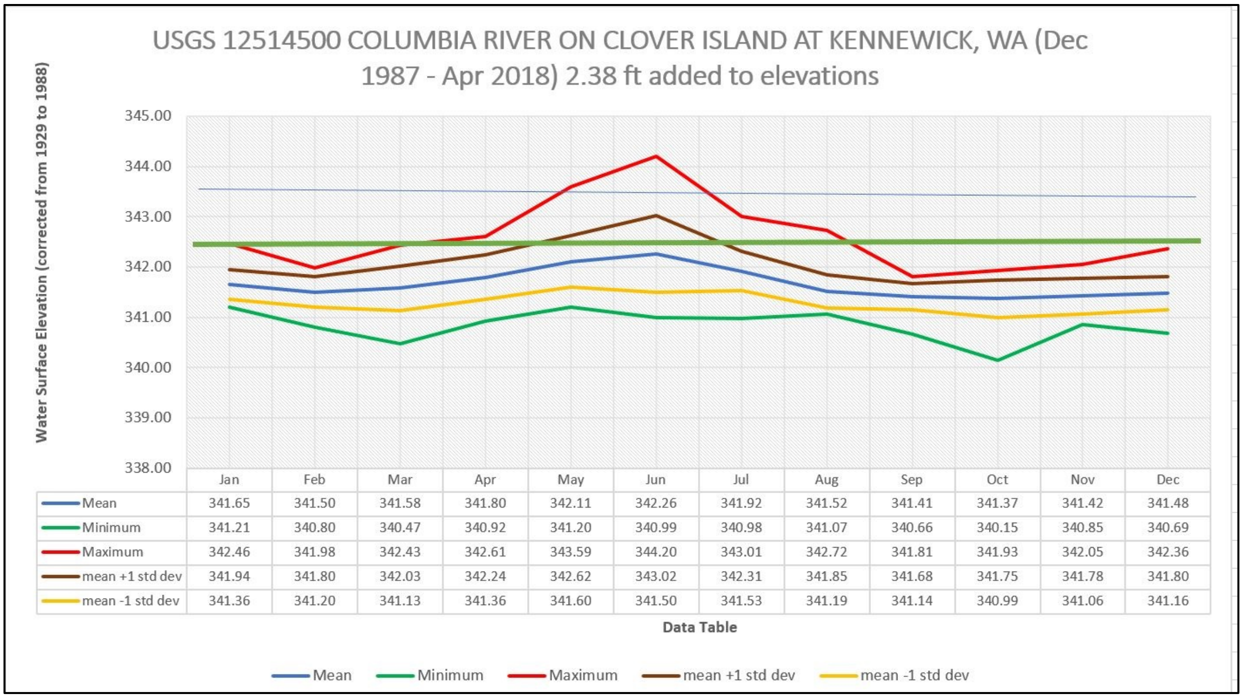

Figure 5. **Water surface elevation averages near the project site.**

Following clearing and grubbing operations in both scenarios the cofferdam would be installed. It is anticipated that either system would be installed as close to November 1st as possible by the Contractor, and remain in-place for 2-4 weeks to facilitate clearing and grubbing operations.

Removal of the erosion control system would depend on which was employed. If the turbidity curtain and debris boom was used, it would be removed using equipment (likely a crane from the bank) to lift the system components and anchorages out. The anchorage connectors and cabling would be removed by hand, and carried to the embankment for removal. If the straw bale and silt fence system was used, it would be removed by hand or using small equipment, which would carry it to the embankment. Once at the embankment, system components would be removed through the newly built flume structure to land.

Clearing and Grubbing

The Contractor would use hand tools (chain saws, shovels, pry bars, shears, etc.) and an excavator with a grappling attachment to remove vegetation and clear the project site. This would involve removal of 4-5 large trees and brush along 60 feet of the river bank. Efforts would be made to remove this vegetation towards the land-side, to facilitate easier removal. Due to the orientation and position of most of the vegetation, it is expected to fall into the river during clearing and grubbing. This vegetation would be captured within the debris boom and curtain, and removed using the excavator and grapple attachment. Following removal of the surface vegetation, any protruding tree roots or vegetation at or near the water surface would be removed, within the footprint of the planned excavation and structure. All other vegetation would be left in-place to stabilize the riverbed and minimize erosion and disturbance. Once clearing and grubbing was complete, excavation using the sacrificial and temporary trench boxes could commence. The site will be replanted with native tree, shrub and grass species after the construction is complete.

Temporary Gravel Work Platform

This would be necessary to establish a working platform above the ordinary high water (OHW) 342.38. This working platform would provide a safe, stable base for equipment and personnel to install the temporary cofferdam system and to prepare (shape and compact) the foundation for the flume portion of the outlet structure. The depth of the gravel work platform would be no more than 12 inches thick and extend from the river bank cliff no more than 5 ft. The gravel platform will be left in place permanently as bedding for the rip-rap placement. This gravel pad would be approximately 25 feet wide, placed perpendicular to the shoreline at the outlet site.

Temporary Rapidly Deployable Cofferdam System

The historical maximum observed water surface levels in Lake Wallula during the winter construction window leave the possibility, however unlikely, for water to impact the construction of the outlet structure. In order to mitigate this risk, a rapidly deployable cofferdam system will be installed to maintain a dry working area for construction of the outlet structure. The footprint of these cofferdams can vary depending on the specific product, but are expected to be approximately 10 feet wide or less. After completion of the flume concrete, the cofferdam can be easily and quickly removed with no impact to the existing substrate before placement of the rip-rap.

Excavation for Baffled Outlet Structure and Flume

Once clearing and grubbing is complete and the cofferdam is in place, excavation can commence from the existing surface. The excavation would be advanced from the top of bank, most likely working from the shoreline inland. Due to right-of-way limitations, the excavation will require a shoring system to facilitate vertical sidewall excavation. The vertical walls would be stabilized, which can be done using any number of typical methods (trench boxes, pile and lagging, sheet piling, soldier piles walls, etc.). The excavation would be made to the required elevation as shown in the drawings. The foundation would be prepared and compacted to the requirements in the specifications, protected by the cofferdam and shoring systems. Once the foundation was prepared, construction of the reinforced concrete flume structure would be completed. Following placement of the flume structure, the shoring system would be removed as the side walls of the flume are backfilled and compacted in 12 inch lift intervals. This process would be repeated until the backfill was brought back to near original grade, and to elevations shown on the drawings.

Dewatering

Based on geotechnical exploration, the groundwater in the vicinity of the outlet structure appears to be reflective of the river/lake level. The expectation is that the groundwater would be below the bottom of the foundation for the flume structure. It is possible that some water may still enter the excavation as bank storage in the formation drains off into the excavation, or may rise up into the excavation via capillary migration. The inflow would be managed with a sump pit and small pump. It is expected that a 2-inch diameter trash pump would be suitable for this work. The intake of trash pump will have NMFS approved intake screen, to prevent fish intake during operation. It is anticipated that this pump would be approximately 20 gallons per minute, but the Contractor will be responsible for proper sizing to maintain a dry work site.

In the event of unexpected high lake levels during the winter work window, very low volumes of water may seep under the coffer dam. In this case, a NMFS screened sump pump would be utilized to remove the water and discharge it up into the over-land work site.

Rip-rap Placement

The last phase of construction on the shoreline would be the placement of permanent rip-rap. A 24-inch thick layer of rip-rap will be placed over the gravel platform previously placed during construction. The coarse rip-rap will consist of maximum 12-inch diameter stone, with a blend of gravel and sand in order to close void spaces between rip-rap particles. This rip-rap would be approximately 25 to 30 feet wide, and extend for 5 feet from the embankment.

Environmental Baseline

The Snake and Columbia River systems, within the action area for the proposed project, have been substantially modified to the detriment of listed salmonids. The most conspicuous habitat modifications are caused by dams on these rivers. The dams have transformed portions of the rivers from fully lotic to essentially lentic environments. The reduction in absolute water velocity and desynchronization of historical runoff patterns has dramatically altered the physical characteristics of both rivers. Additionally, sediment transport and deposition dynamics, water temperature, habitat diversity, and habitat access have been altered to the detriment of listed salmonids as a result of dam construction (Spence et al. 1996, ACOE 1989).

Concurrent with physical changes, indirect biological transformation has also occurred. Exotic species that prey on salmonids, including percids and centrarchids, have become established in the Snake and Columbia Rivers (Wydoski and Whitney 1979). These predators may feed directly on salmonids (Tabor et al. 1993) or compete for other food or habitat resources. Other native predators including the Northern pikeminnow (*Ptychocheilus oregonensis*) have exploited the impounded environment created by dams, although their predation rates are higher in the lower Columbia River (Faler et al. 1988).

A number of general anthropogenic factors have also influenced listed species. Along the shores of the Snake and Columbia Rivers, agriculture, transportation infrastructure, commercial and residential development have displaced riparian and shallow water habitat used by juvenile salmonids. This development also contributes some quantity of runoff and pollution, which may include sediments, fertilizer, pesticides, and petroleum products.

Fisheries

The information presented below summarizes the status of West Coast Salmon and steelhead ESUs and DPSs that are the subject of this consultation. Much of the information, particularly concerning Snake River species, has been taken directly from the 2004 FCRPS BO (NMFS 2004).

Upper Columbia River Spring-run Chinook Salmon

On March 24, 1999, NMFS listed UCR spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) as an endangered species (64 FR 14308) and their endangered status was affirmed on June 28, 2005 (70 FR 37160). This ESU includes all naturally spawned populations of Chinook Salmon in all river reaches accessible to Chinook Salmon in Columbia River tributaries upstream of Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River. The ESU also includes six artificial propagation programs: the Twisp River, Chewuch River, Methow Composite, Winthrop NFH, Chiwawa River, and White River spring-run Chinook Salmon hatchery programs. NMFS determined that these artificially propagated stocks are no more divergent relative to the local natural populations than what would be expected between closely related natural populations within the ESU (70 FR 37160). The spring-run Chinook Salmon hatchery program at the Entiat National Fish Hatchery was determined to be a threat to the ESU and was discontinued in 2007.

For recovery planning and development of recovery criteria, the Interior Columbia Technical Recovery Team (ICTRT) identified independent populations within the UCR spring-run Chinook Salmon ESU and grouped them into genetically similar MPGs (ICTRT 2003). Within the UCR spring-run Chinook Salmon ESU, there are four independent populations (three extant and one extinct) that all belong to one genetically similar MPG (Eastern Cascades) (Figure 6). A historic population in the Okanogan River has been extirpated (ICTRT 2005).

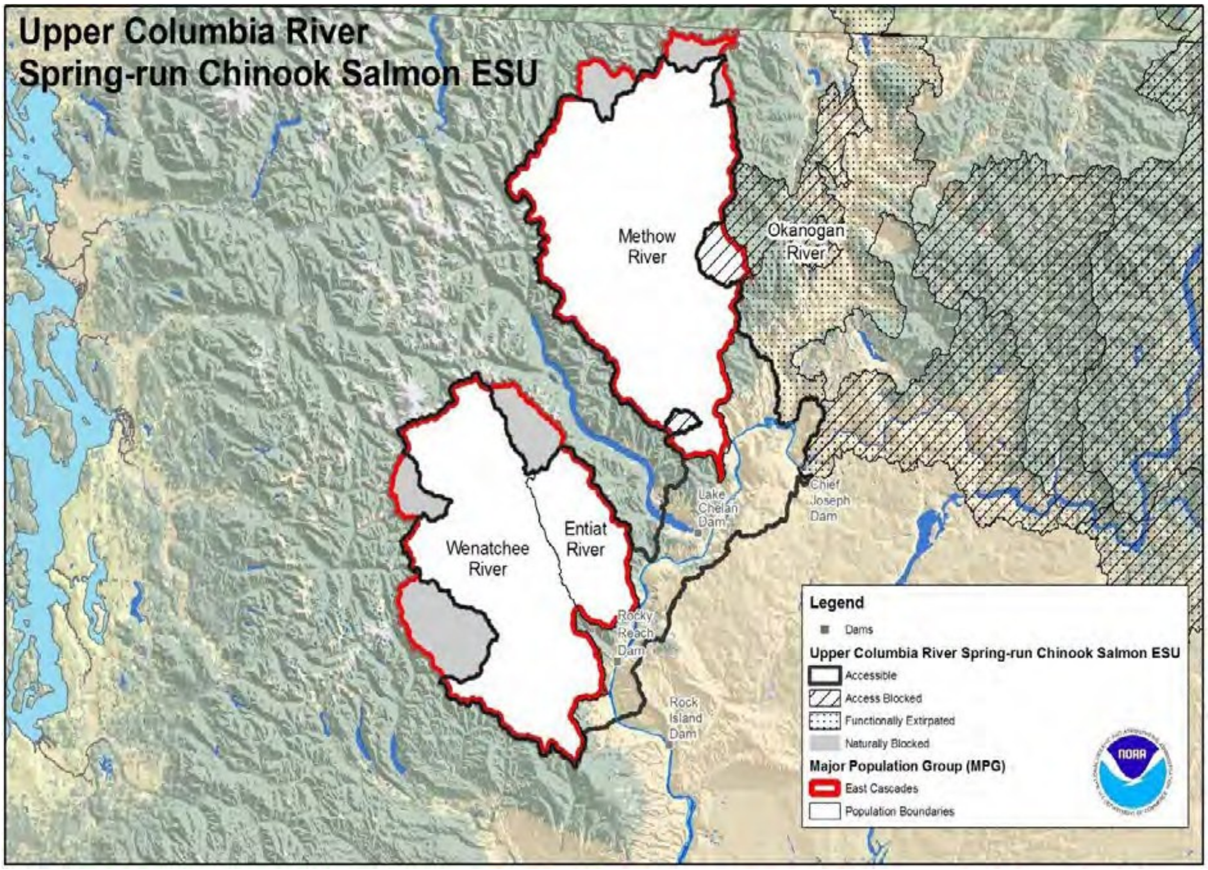

Figure 6. **UCR spring-run Chinook Salmon ESU population structure.**

Life History

Chapter 8 of the *Comprehensive Analysis* (Action Agencies 2007) contains additional information about the life history and population status of this ESU and is incorporated here by reference.

Spring-run Chinook Salmon in this ESU have a stream-type life history, which means that juveniles enter marine waters during their second year and return to freshwater as preadults, maturing during their upriver spawning run. Three independent populations of spring-run Chinook Salmon are identified for the ESU, those that spawn in the Wenatchee, Entiat, and Methow River Basins. Most of these fish return to the Columbia River from March through mid-May. Adults returning to the Wenatchee River enter freshwater from late March through early May; those returning to the Entiat and Methow Rivers enter freshwater from late March through June. Their arrival times tend to be earlier in low-flow years and later in high-flow years. On their way upriver, the fish hold in deeper pools or under cover until the onset of spawning. They may spawn in the areas where they hold, or move further up into smaller tributaries. Peak spawning for all three populations occurs from August to September, though the timing is highly dependent upon water temperature. Most adults return after spending 2 years in the ocean, although 20 to 40 percent return after 3 years at sea.

The egg incubation/alevin stage goes from August into December and emergence extends from that point into March. The juveniles typically spend 1 year in freshwater before migrating downstream, primarily in May and June.

Population Trends and Risks

The UCR spring-run Chinook Salmon ESU continues to have habitat problems. In general, tributary habitat problems affecting this ESU include increasing urbanization on the lower reaches, irrigation and flow diversion in upriver sections of the major drainages, and impacts of grazing on middle reaches (Good et al. 2005). Limiting factors identified for this species include: (1) Mainstem Columbia River hydropower system mortality; (2) tributary riparian degradation and loss of in-river wood; (3) altered tributary floodplain and channel morphology; (4) reduced tributary streamflow and impaired passage; and (5) harvest impacts (NMFS 2005).

In March 2007, the ICTRT proposed minimum abundance thresholds for interior Columbia Basin stream-type Chinook Salmon populations. Subsequently, in 2007, NMFS issued a final recovery plan for the UCR spring-run Chinook Salmon ESU which adopted the ICTRT 2007 viability goals as biological delisting criteria (72 FR 57303). These recovery goals represent the numbers that, taken together, may be needed for the population to be self-sustaining or recovered in its natural ecosystem. For UCR spring- run Chinook Salmon, the minimum abundance thresholds are 2,000 spawners each in the Wenatchee and Methow river basins and 500 spawners in the Entiat River basin (ICTRT 2008). The ICTRT (2008) has completed viability assessments for all but two populations of UCR Chinook Salmon and found all to be not viable.

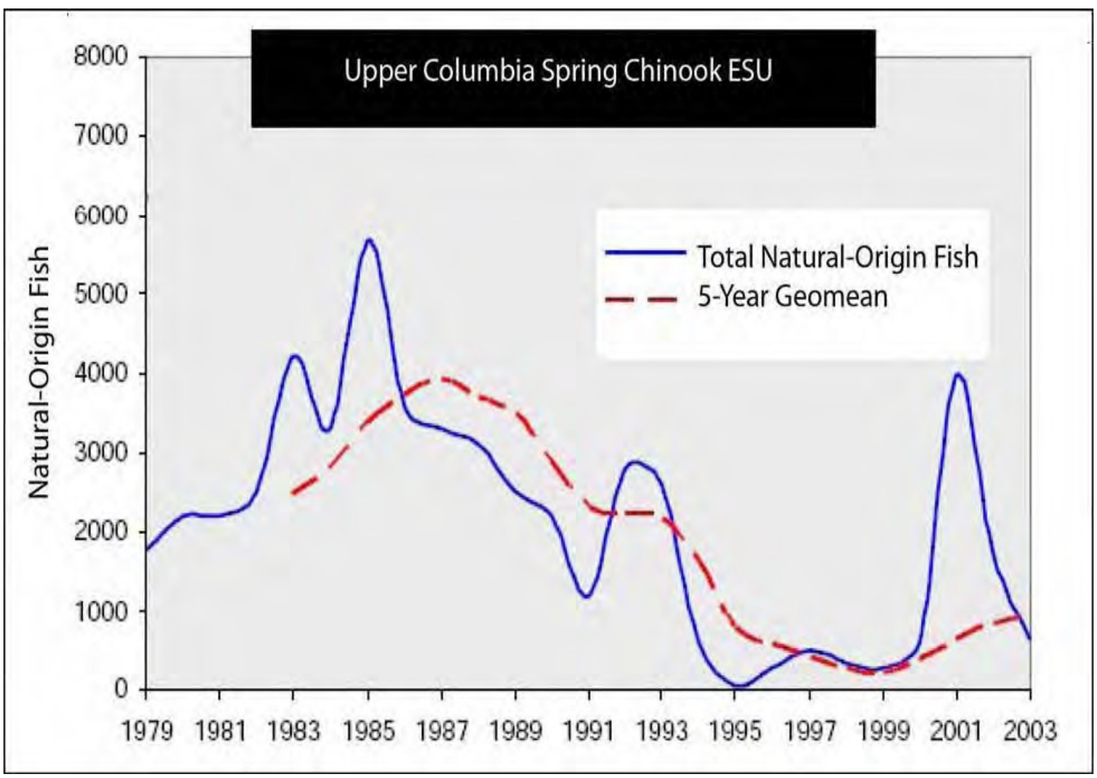

Figure 7. Upper Columbia River Spring-run Chinook Salmon abundance trends (NMFS 2008b).

ESU Summary

Although there has been an increase of abundance for all three UCR spring-run Chinook Salmon populations, overall productivity has decreased and the ESU remains at a high risk of extinction. Since the ESU-level recovery criteria require that all the extant populations within this single MPG be rated as viable for the ESU to be viable, more progress must be made before the UCR spring-run Chinook Salmon ESU can be considered recovered.

Several factors cited in the previous and current status review (Good et al. 2005; Ford et al. 2010) remain concerns or key uncertainties for all three extant populations. Increases in natural-origin abundance relative to the extremely low spawning levels observed in the mid-1990s are encouraging. However, average productivity levels remain extremely low. Large-scale directed supplementation programs are underway in the Wenatchee and Methow populations. These programs are intended to mitigate short- term demographic risks while actions to improve natural productivity and capacity are implemented. While these programs may provide short-term demographic benefits, there are significant uncertainties regarding the long-term risks of relying on high levels of hatchery influx to maintain natural populations.

Overall, the new information considered does not indicate a change in the biological risk category since the time of the last status review in 2016. The viability of the UCR spring-run Chinook Salmon ESU has likely improved somewhat; however, the ESU remains at a moderate-to-high risk of extinction. None of the populations meet the ICTRT’s 2007 biological recovery criteria (ICTRT 2007).

Upper Columbia River Steelhead

The UCR steelhead (*Oncorhynchus mykiss*) distinct population segment (DPS) was listed as endangered on August 18, 1997 (62 FR 43937). Their status was upgraded to threatened on January 5, 2006 (71 FR 834) and then reinstated to endangered status per U.S. District Court decision in June 2007. This DPS includes all naturally spawned anadromous steelhead populations below natural and manmade impassable barriers in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S.-Canada border (62 FR 43937). Six artificial propagation programs are considered part of the DPS—the Wenatchee River, Wells Hatchery (in the Methow and Okanogan rivers), Winthrop National Fish Hatchery (NFH), Omak Creek, and the Ringold steelhead hatchery programs. NMFS determined that these artificially propagated stocks are no more divergent relative to the local natural populations than what would be expected between closely related natural populations within the DPS (71 FR 834).

The ICTRT has identified five independent populations within this DPS—the Wenatchee River, Entiat River, Methow River, Okanogan Basin, and Crab Creek (ICTRT 2005). Within the UCR steelhead DPS, there are only four independent extant populations belonging to one genetically similar MPG (Figure 8). The Crab Creek anadromous component was determined to be functionally extirpated by NMFS (ICTRT 2007).

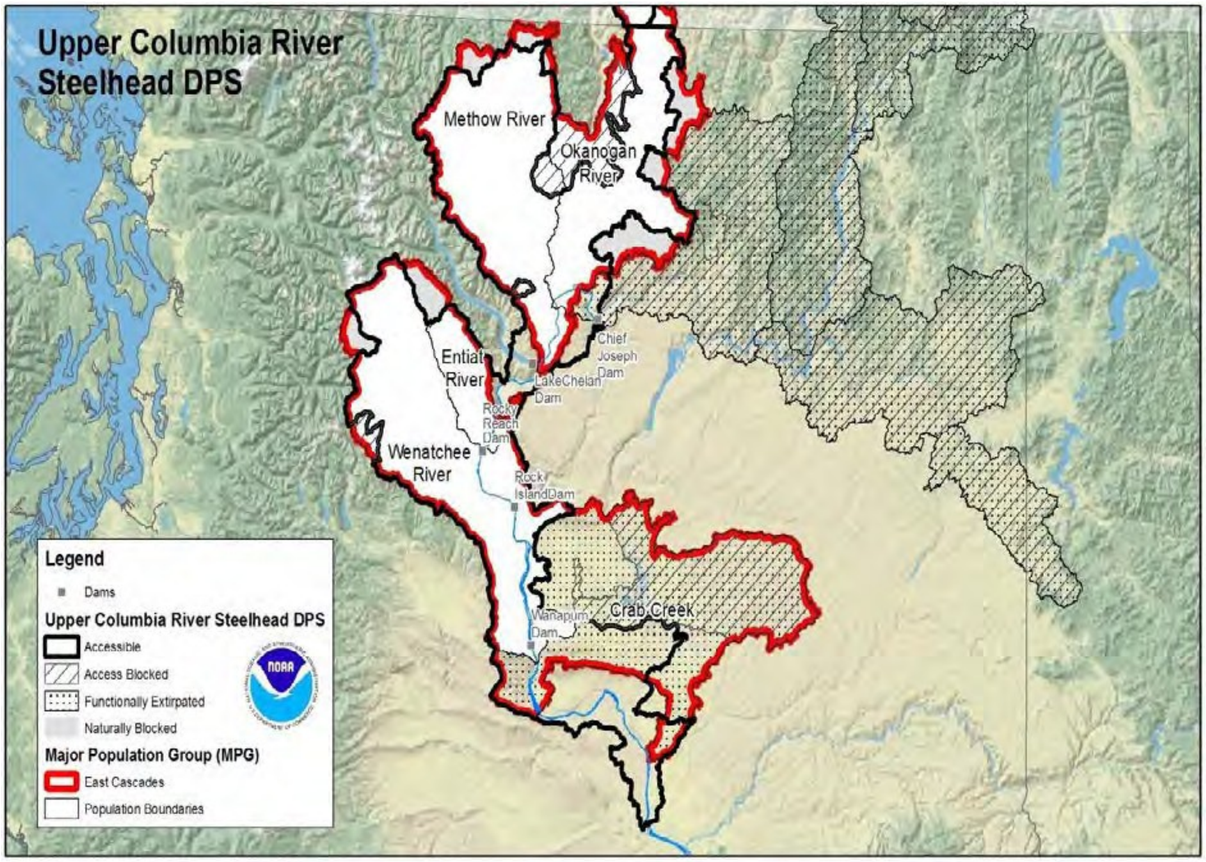

Figure 8. UCR steelhead DPS population structure.

Life History

Chapter 9 of the *Comprehensive Analysis* (Action Agencies 2007) contains additional information about the life history and population status of this ESU and is incorporated here by reference.

Life-history characteristics for UCR steelhead are similar to those of other inland steelhead DPSs. Unlike Pacific salmon, steelhead are capable of spawning more than once before death and adults attempt to migrate back to the ocean after spawning. These fish are known as kelts, and those that survive will migrate from the ocean to spawn again. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females. Steelhead can be divided into two basic run types based on their level of sexual maturity at the time they enter freshwater and the duration of the spawning migration. The stream-maturing type, or summer steelhead, enters freshwater in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters freshwater with well-developed gonads and spawns relatively shortly after river entry. Fish in the UCR steelhead ESU are made up entirely of summer steelhead.

Upper Columbia River steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. They sometimes also use smaller streams for spawning. The adult steelhead enter freshwater between May and October. During summer and fall before spawning, they hold in cool, deep pools. They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration to natal streams in early spring, and then spawn. In general, adults in this ESU spawn later than in most downstream populations—often remaining in freshwater for a year before spawning.

Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months before hatching. Rearing takes place primarily in the faster parts of pools, although young-of- the-year are abundant in glides and riffles. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers. Productive steelhead habitat is characterized by complexity—primarily in the form of large and small wood.

The dry habitat conditions in the Upper Columbia River are less conducive to steelhead survival than in many other parts of the Columbia River Basin. Although the life history of this ESU is similar to that of other inland steelhead, smolt ages are some of the oldest on the West Coast (up to 7 years old), probably due to the area's cold water temperatures. The cold stream temperatures also lead to the possibility that many fish in this ESU may be thermally-fated to a resident (rainbow trout) life history regardless of whether they are the progeny of resident or anadromous parents. Most current natural production occurs in the Wenatchee and Methow river systems, with a smaller run returning to the Entiat River. Very limited spawning also occurs in the Okanagan River Basin. Most of the fish spawning in natural production areas are of hatchery origin. The limited data available indicate that smolt age in this ESU is dominated by 2- year-olds. It also appears that steelhead from the Wenatchee and Entiat rivers return to freshwater after 1 year in salt water, whereas Methow River steelhead primarily return after 2 years of ocean residence.

Population Trends and Risks

The UCR steelhead DPS continues to experience problems including genetic homogenization from hatchery supplementation (reducing genetic variations from levels that support viability), high harvest rates on steelhead smolts in rainbow trout fisheries (reducing abundance), and the degradation of freshwater habitats within the region (negatively affecting spatial structure and productivity, especially the effects of grazing, irrigation diversions, and hydroelectric dams) (Good et al. 2005).

Limiting factors identified for the UCR steelhead include: (1) Mainstem Columbia River hydropower system mortality; (2) reduced tributary streamflow; (3) tributary riparian degradation and loss of in-river wood; (4) altered tributary floodplain and channel morphology; and (5) excessive fine sediment and degraded tributary water quality (NMFS 2005).

In March 2007, the ICTRT proposed minimum abundance thresholds for interior Columbia Basin steelhead populations. Subsequently in 2007, NMFS issued a final recovery plan for the UCR steelhead DPS which adopted the ICTRT 2007 viability goals as biological delisting criteria (72 FR 57303). These recovery goals represent the numbers that taken together, may be needed for the population to be self-sustaining, or recovered, in its natural ecosystem. For UCR steelhead, the minimum abundance thresholds are 1,000 spawners each in the Wenatchee, Methow, and Okanogan river basins, and 500 spawners in the Entiat River basin (ICTRT 2007).

The recovery strategies outlined in the recovery plan are targeted to achieve, at a minimum, the biological criteria for the UCR steelhead DPS.

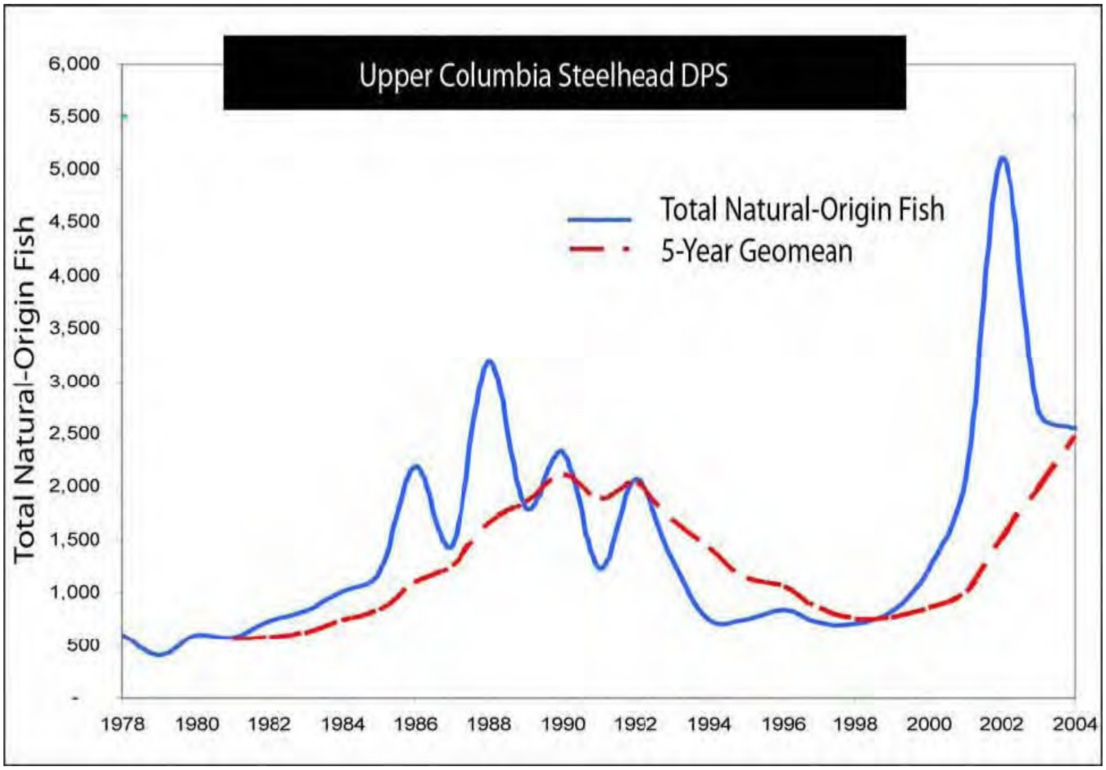

Figure 9. Upper Columbia River steelhead DPS population trends (NMFS 2008b).

DPS Summary

Although there has been an increase in abundance and productivity for all four UCR steelhead populations, the improvement has been minor, and none of the populations meet the recovery criteria established in the UCR Recovery Plan. Since the DPS-level recovery criteria require that all four populations be viable, more progress must be made before the UCR steelhead can be considered recovered.

Several factors cited in the previous status review (Good et al. 2005) remain concerns or key uncertainties in the 2016 status review (NMFS 2016). UCR steelhead populations have increased in natural-origin abundance in recent years, but productivity levels continue to remain low. The proportion of hatchery-origin returns in natural spawning areas remains extremely high across the DPS, especially in the Methow and Okanogan River populations. Recent improvements in natural returns, although modest, are most likely the result of several years of relatively good 'natural' ocean and tributary habitat survival conditions.

Overall, the new information considered does not indicate a change in the biological risk category since the time of the last status review. Direct biological performance measures for this DPS indicate modest progress to date toward meeting viability criteria. New information considered during this review confirms that all populations within this DPS are at high risk and the DPS, as a whole, is not viable.

Middle Columbia River Steelhead

The MCR steelhead DPS was listed as threatened on March 25, 1999 (64 FR 14517) and its threatened status was reaffirmed on June 28, 2005 (70 FR 37160). This DPS includes all naturally spawned populations of steelhead in streams from above Wind River, Washington, and the Hood River, Oregon, upstream to, and including, the Yakima River, Washington, excluding steelhead from the Snake River basin (SRB). Seven artificial propagation programs are considered part of the DPS—The Touchet River Endemic, Yakima River Kelt Reconditioning Program (in Satus Creek, Toppenish Creek, Naches River, and Upper Yakima River), Umatilla River, and the Deschutes River steelhead hatchery programs. NMFS determined that these artificially propagated stocks are no more divergent relative to the local natural populations than what would be expected between closely related natural populations within the DPS (71 FR 834).

Major watersheds within this DPS include the Klickitat, Fifteenmile, Deschutes, John Day, Umatilla, Yakima, and Walla Walla basins. The ICTRT (2007) identified 20 populations in four MPGs (Eastern Cascades, John Day River, the Umatilla/Walla Walla, and the Yakima River). There are three extinct populations in the Eastern Cascades MPG (the White Salmon and Crooked River populations), and the Willow Creek population in the Umatilla Rivers/Walla Walla MPG (Figure 10).

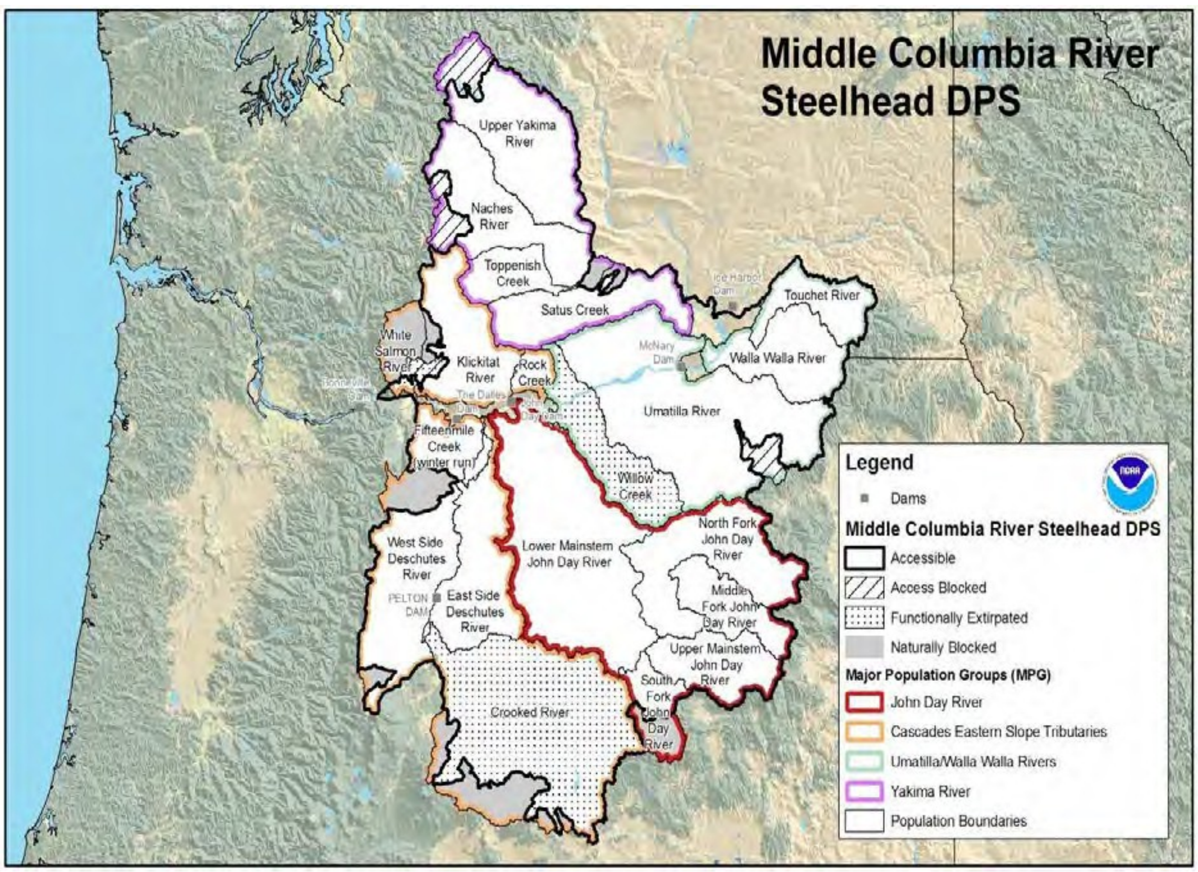

Figure 10. MCR steelhead DPS population structure.

Life History

Chapter 10 of the *Comprehensive Analysis* (Action Agencies 2007) contains additional information about the life history and population status of this ESU and is incorporated here by reference.

Life-history characteristics for MCR steelhead are similar to those of other inland steelhead DPSs. Unlike Pacific salmon, steelhead are capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females. Steelhead can be divided into two basic run types based on their level of sexual maturity at the time they enter freshwater and the duration of the spawning migration. The stream-maturing type, or summer steelhead, enters freshwater in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters freshwater with well-developed gonads and spawns relatively shortly after river entry. Fish in the MCR steelhead ESU are predominantly summer steelhead. All steelhead upstream of The Dalles Dam are summer-run (Reisenbichler et al. 1992) fish that enter the Columbia River from June to August. However, winter-run fish are found in lower numbers in the Klickitat River, Washington, and Fifteenmile Creek, Oregon.

Both types of steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. They sometimes also use smaller streams for spawning. Summer steelhead enter freshwater between May and October. During summer and fall before spawning, they hold in cool, deep pools. They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration to natal streams in early spring, and then spawn. Winter steelhead enter freshwater between November and April in the Pacific Northwest, migrate to spawning areas, and then spawn in late winter or spring.

Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months before hatching. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers. Productive steelhead habitat is characterized by complexity—primarily in the form of large and small wood.

Most fish in this ESU smolt at 2 years and spend 1-2 years in salt water before reentering freshwater, where they may remain for up to a year before spawning. Age-2-ocean steelhead dominate the summer steelhead run in the Klickitat River, whereas most other rivers with summer steelhead produce about equal numbers of both age-1- and age-2 ocean fish. Juvenile life stages (i.e., eggs, alevins, fry, and parr) inhabit freshwater/ riverine areas throughout the range of the ESU. Parr usually undergo a smolt transformation as 2-year-olds, at which time they migrate to the ocean. Subadults and adults forage in coastal and offshore waters of the North Pacific Ocean before returning to spawn in their natal streams. A nonanadromous form of *O. mykiss* (redband and rainbow trout) co-occurs with the anadromous form in this ESU, and juvenile life stages of the two forms can be very difficult to differentiate. In addition, hatchery steelhead are also distributed within the range of this ESU.

Population Trends and Risks

Numerous factors across the MCR steelhead DPS that led to its listing in 1999 continue to exert substantial influence on anadromous fish production. These factors include declines in abundance of naturally produced fish, heavy harvest pressures, significant habitat loss, losses associated with mainstem Columbia River hydropower projects, grazing, irrigation diversions, and pervasive hatchery impacts that affect the viability of steelhead populations (McClure et al. 2003). Limiting factors identified for MCR steelhead include: (1) Hydropower system mortality at mainstem Columbia River dams; (2) Reduced streamflow in tributaries; (3) Impaired passage in tributaries; (4) Excessive fine sediment in stream substrates; (5) Degraded water quality; and (6) Altered channel morphology (NMFS 2005).

In 2009, NMFS issued a final recovery plan for MCR steelhead, which adopted the ICTRT viability criteria as biological delisting goals (NMFS 2009). The recovery strategies outlined in the MCR recovery plan are targeted to achieve, at a minimum, the biological criteria for each MPG in the DPS. The criteria are, ". . . [t]o have all four major population groups at viable (low risk) status with representation of all the major life-history strategies present historically, and with the abundance, productivity spatial structure and diversity attributes required for long-term persistence." The Plan recognizes that there may be several different combinations of population status that could satisfy the biological criteria for each MPG and identifies the combinations most likely to result in achieving viability for each MPG (NMFS 2009; Ford et al. 2010).

In addition to recommending recovery criteria, the ICTRT also assessed the current status of each population within the DPS (ICTRT 2007). Each population was rated against the biological criteria identified in the recovery plan and assigned a current viability rating. Information provided below was summarized from Ford et al. (2010)—Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Northwest.

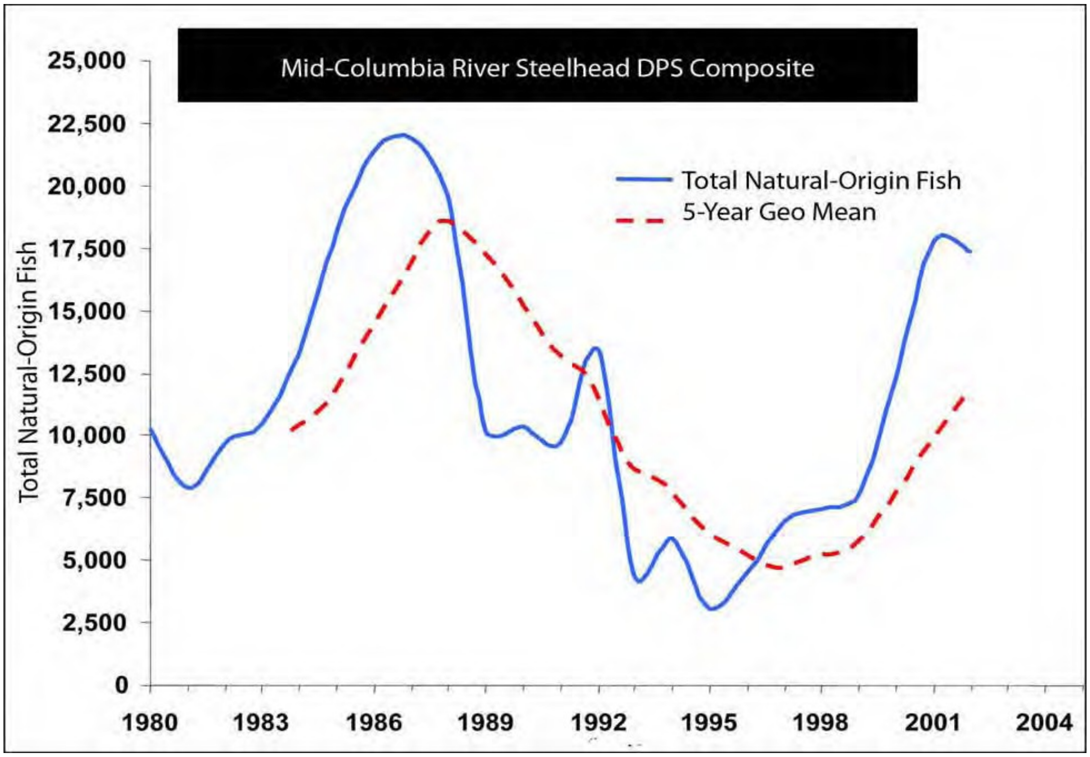

Figure 11. Middle Columbia River steelhead population trends (NMFS 2008b).

Cascades Eastern Slope Tributaries MPG

Abundance data are available for three (Fifteenmile Creek, East Side Deschutes, and West Side Deschutes) of the five extant populations in the Cascades Eastern Slope Tributaries MPG along with 2 years of estimates for a fourth population (Klickitat River). Total spawning abundance for the most recent 5-year series (2005-2009) is below the levels reported in the last status review for the three populations. However, natural- origin spawner abundance is higher for the more recent estimates (for all three populations with more than 2 years of abundance estimates). Estimates of the proportion of natural-origin spawners were higher for all three (Fifteenmile Creek, East Side Deschutes, and West Side Deschutes) populations in the most recent brood cycle (Ford et al. 2010). Based on mark-recapture analysis during 2006-2007, an average of 1,450 natural and 1,670 hatchery steelhead passed upstream of the Klickitat Falls and into spawning reaches in the Klickitat River.

John Day River MPG

Total escapement and natural-origin escapement were down from the levels reported in the previous status review for four (Upper Mainstem, North Fork, Middle Fork, and Lower Mainstem) out of the five John Day populations. Both total and natural-origin spawning escapements in the South Fork John Day River were higher in the more recent brood cycle than in 1997-2001. Estimates of the fraction of natural-origin spawners were relatively unchanged for the upstream John Day populations, but had increased for the Lower Mainstem John Day River (Ford et al. 2010).

Yakima River MPG

Total and natural-origin escapement estimates were higher in the most recent brood cycle for all four of the Yakima River populations than in the cycle associated with the 2005 status review. Steelhead escapements into the Upper Yakima River, although increased relative to the previous review, remain very low relative to the total amount of habitat available. The proportion of natural-origin fish remained high in the Yakima River basin (estimated for aggregate run at Prosser Dam) (Ford et al. 2010).

Umatilla/Walla Walla Rivers MPG

Total spawning escapements have increased in the most recent brood cycle over the period associated with the last status review for all three populations in the Umatilla/ Walla Walla Rivers MPG. Natural-origin escapements are higher for two populations (Umatilla River and Walla Walla River) while remaining at approximately the same level as in the prior review for the Touchet River (Ford et al. 2010).

DPS Summary

Although there have been improvements in the viability ratings for some of the component populations, none of the MPGs are meeting the recovery criteria and only 3 of the 17 extant populations are considered to be viable. Since the DPS-level recovery criteria require that all four MPGs be rated as viable, more progress must be made before this MCR steelhead DPS can be considered recovered.

Several factors cited in the previous status review (Good et al. 2005) remain concerns or key uncertainties in the 2010 status review (Ford et al. 2010). Natural-origin spawning estimates are highly variable relative to minimum abundance thresholds across the populations in the DPS. Some populations, such as the North Fork John Day, are rated highly viable and have consistently high abundance, while several other populations remain at high risk. Updated information indicates that straying levels into at least the Lower John Day River population are also high. Returns to the Yakima River Basin and to the Umatilla and Walla Walla rivers have been higher over the most recent brood cycle while natural-origin returns to the John Day River have decreased. Out-of-basin hatchery stray proportions, although reduced, remain very high in the Deschutes River Basin.

Overall, the new information considered in the 2010 status review does not indicate a change in the biological risk category since the time of the last status review. Although direct biological performance measures for this DPS indicate little realized progress to date toward meeting its recovery criteria, there is no new information to indicate that its extinction risk has increased significantly. The DPS remains well distributed throughout its historical range in the Middle Columbia River Basin and at least some populations are considered to be viable. The percentage of natural-origin spawners is relatively high (70- 99 percent; Ford et al. 2010) and the estimates of total DPS abundance indicates that the DPS is not at immediate risk of extinction. New information considered during the 2010 review confirmed that this DPS remains at moderate risk of extinction (NMFS 2016).

Snake River Spring/Summer Chinook Salmon

The NMFS listed Snake River (SR) spring/summer Chinook Salmon as threatened, and protective regulations were issued under Section 4(d) of the Endangered Species Act (ESA), on April 22, 1992 (57 FR 14653). Their threatened status was reaffirmed on June 28, 2005 (70 FR 37160). The ESU includes all naturally spawned populations of SR spring/summer Chinook Salmon in the mainstem Snake River, Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins (57 FR 23458). Fifteen artificial propagation programs are also considered to be part of the ESU:

- Tucannon River Conventional Hatchery,
- Tucannon River Captive Broodstock Program,
- Lostine River,
- Catherine Creek,
- Lookingglass Hatchery Reintroduction Program,
- Upper Grande Ronde,
- Imnaha River,
- Big Sheep Creek,
- McCall Hatchery,
- Johnson Creek Artificial Propagation Enhancement,
- Lemhi River Captive Rearing Experiment,
- Pahsimeroi Hatchery,
- East Fork Captive Rearing Experiment,
- West Fork Yankee Fork Captive Rearing Experiment, and
- Sawtooth Hatchery spring/summer-run Chinook hatchery programs.

NMFS determined that these artificially propagated stocks are no more divergent relative to the local natural populations than what would be expected between closely related natural populations within the ESU (70 FR 37160).

NMFS is currently writing a recovery plan for the four ESA-listed Snake River salmon and steelhead species addressed in the 2010 5-year status review; therefore, final or interim recovery criteria are not currently available. NMFS has initiated recovery planning for the Snake River listed species based upon three management unit (MU) plans–Idaho, northeast Oregon and southeast Washington–encompassing the Snake River drainage. The ICTRT recommended MPG-level scenarios consistent with the ICTRT biological criteria for each ESU/DPS and will be used to develop proposed recovery strategies for each ESA-listed SR salmon and steelhead species in the draft Snake River recovery plan.

For the purposes of reproduction, salmon and steelhead typically exhibit a metapopulation structure (Schtickzelle and Quinn 2007, McElhany et al. 2000). Rather than interbreeding as one large aggregation, ESUs and DPSs function as a group of demographically independent populations separated by areas of unsuitable spawning habitat. For conservation and management purposes, it is important to identify the independent populations that make up an ESU or DPS. For the purposes of recovery planning and development of recovery criteria, the ICTRT identified independent populations for each SR ESA-listed species, and grouped them together into genetically similar MPGs (ICTRT 2003). The SR spring/summer Chinook Salmon ESU is comprised of 28 extant populations in five MPGs—Lower Snake River, Grande Ronde/Imnaha, South Fork Salmon River, Middle Fork Salmon River, and the Upper Salmon River (Figure 12). Historic populations above Hells Canyon Dam are considered extinct (ICTRT 2005).

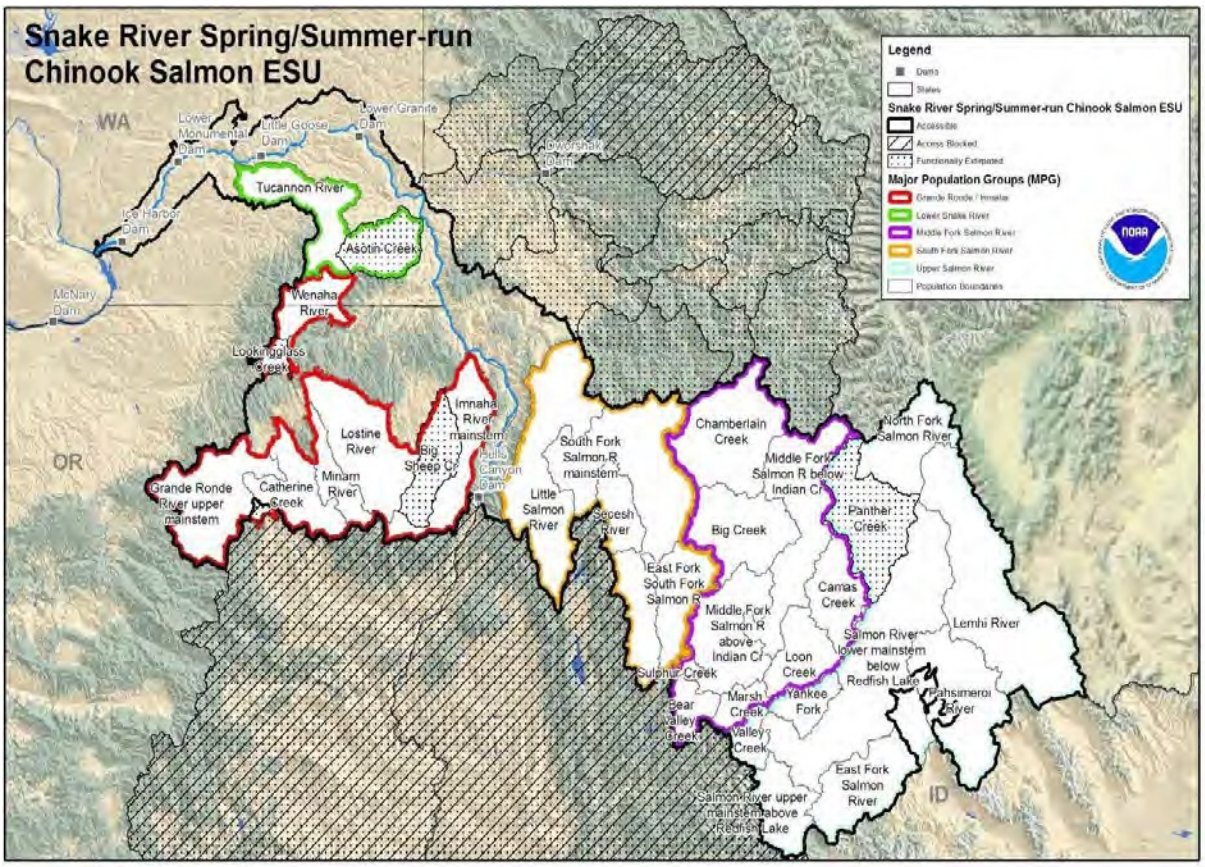

Figure 12. **Snake River Spring/Summer Chinook Salmon ESU population structure.**

Life History

Chapter 5 of the *Comprehensive Analysis* (Action Agencies 2007) contains additional information about the life history and population status of this ESU and is incorporated here by reference.

Snake River spring/summer-run Chinook Salmon exhibit a stream-type life history. Juvenile fish mature in freshwater for 1 year before they migrate to the ocean in the spring of their second year. Adults reenter the Columbia River in late February and early March after 2 or 3 years in the ocean. In high-elevation areas, mature fish hold in cool, deep pools of larger river systems until late summer and early fall, when they return to their native tributary streams to spawn. Eggs incubate through the fall and winter and emergence begins in the late winter and early spring. Juveniles migrate through the Columbia River mainstem from early May through mid-June.

Lower Snake River MPG

This MPG contained two populations historically; Asotin Creek is identified as extirpated. The ICTRT criteria call for both populations to be restored to viable status. The ICTRT recommended that recovery planners should give priority to restoring the Tucannon River to highly viable status, and deferring an evaluation of the potential for reintroducing production in Asotin Creek as recovery planning progresses.

Grande Ronde/Imnaha MPG

This MPG has eight historical populations (two identified as extirpated–Big Sheep Creek and Lookingglass Creek). The ICTRT criteria call for a minimum of four populations to be at viable or highly viable status. The potential scenario identified by the ICTRT would include viable populations in the Imnaha River (representing important run-timing diversity), the Lostine/Wallowa River (representing a large-size population) and at least one from each of the following pairs: Catherine Creek or Upper Grande Ronde (representing large-size populations); and Minam River or Wenaha River.

South Fork Salmon River MPG

Four populations comprise this MPG, with two classified as large-size and two as intermediate-size. The South Fork Salmon River drainage contains three of the populations; the fourth lies outside of the drainage. At least two of the populations (one intermediate and one large) must be at viable status for the MPG to be considered viable, and one of these two must be highly viable. One population in the MPG (Little Salmon River) is a spring/summer run type and the remaining three are the summer-only run type. The ICTRT MPG–level viability criteria require that the Little Salmon River population be viable for the MPG to be considered viable. The ICTRT recommends that the populations in the South Fork drainages be given priority relative to meeting MPG viability objectives because of the relatively small size and the high level of potential hatchery integration for the Little Salmon River population. The viability for this MPG relies on the production of summer-run type populations with the South Fork Salmon River drainage, rather than the inclusion of a minor amount of spring-run type production from outside the main drainage. Therefore, a recovery scenario for this MPG should not emphasize the life-history strategy requirement of MPG viability. Rather, this recovery scenario should emphasize the need to achieve viable status for the Secesh River population which has no supplementation and will satisfy the intermediate-size requirement for MPG viability. The South Fork Salmon River population is the initial choice by NMFS to meet the requirements of a large population.

Middle Fork Salmon River MPG

The ICTRT criteria call for at least five of the nine populations in this MPG to be rated as viable, with at least one demonstrating highly viable status. When all six MPG-level viability criteria are considered, there are 45 possible scenarios in which five populations, selected from the nine, could achieve MPG viability. The Big Creek population must be viable in any scenario because of its unique historic intrinsic potential in the MPG. It is the only population that meets the ICTRT large size category, and is one of two populations that include both spring- and summer-run fish. At least two of the three intermediate size populations (Chamberlain Creek, Middle Fork Salmon River above Indian Creek, and Bear Valley Creek) must be included among the minimum of five viable populations. In order to satisfy the intermediate-size population requirement, a viable status is targeted for the Chamberlain Creek and Bear Valley Creek populations. This is based on management opportunity and historic production potential. Two other populations must be viable to meet the minimum requirement of five viable populations.

The choices include Middle Fork Salmon River below Indian Creek, Camas Creek, Loon Creek, Middle Fork Salmon River above Indian Creek, Sulphur Creek, and Marsh Creek. The Loon Creek and Marsh Creek populations are targeted for desired viable status, because of their geographic distribution in the MPG and historic intrinsic production potential.

Upper Salmon River MPG

This MPG included nine historical populations, one of which (Panther Creek) is considered functionally extirpated. The ICTRT criteria recommend that only three of the five very large and large populations be included. However, because the single intermediate-size population (Panther Creek) is extirpated, an additional population from one of the larger size categories must be substituted for the intermediate-size population in the scenario. The Pahsimeroi River population must be viable because of its unique life-history strategy (it is the only summer-run population) in the MPG. The Pahsimeroi is classified as a large-size population. Therefore, at least three of the other four very large and large populations (Lemhi River, Salmon River Lower Mainstem below Redfish Lake Creek, East Fork Salmon River, and Salmon River Upper Mainstem above Redfish Lake Creek) must be included in the minimum set of five viable populations. Based on spatial distribution, management opportunity, and historical production potential in the MPG, the Lemhi River and Salmon River Upper Mainstem population need to be viable to satisfy the criterion for proportional representation of size class. The East Fork Salmon River population is an initial choice to achieve viable status. Finally, Valley Creek is an initial choice to round out the population selections.

Population Trends and Risk

The 1991 ESA status review (Matthews and Waples 1991) of the SR spring/summer Chinook Salmon ESU concluded that the ESU was at risk. Aggregate abundance of naturally produced SR spring/summer Chinook Salmon runs had dropped to a small fraction of historical levels. Short-term projections (including jack counts and habitat/flow conditions in the brood years producing the next generation of returns) were a continued downward trend in abundance. Risk modeling indicated that if the historical trend in abundance continued, the ESU as a whole was at risk of extinction within 100 years. The 1991 review identified related concerns at the population level within the ESU. Given the large number of potential production areas in the SRB and the low levels of annual abundance, risks to individual subpopulations may be greater than the extinction risk for the ESU as a whole. The 1998 Chinook Salmon status review (Myers et al. 1998) summarized and updated these concerns. Both short- and long-term abundance trends had continued downward. The report identified continuing disruption from mainstem hydroelectric development, including altered flow regimes and impacts on estuarine habitats. The 1998 review also identified regional habitat degradation and risks associated with the use of outside hatchery stocks in particular area, including major sections of the Grande Ronde River basin (Good et al. 2005). Limiting factors identified for this species include: (1) Mainstem lower Snake and Columbia River hydrosystem mortality; (2) reduced tributary streamflow; (3) altered tributary channel morphology; (4) excessive fine sediment in tributaries; and (5) degraded tributary water quality (NMFS 2005).

In March 2007, the ICTRT proposed minimum abundance thresholds for SR spring/summer Chinook Salmon. They represent the numbers that, taken together, may be needed for the population to be self-sustaining, or recovered, in its natural ecosystem. For SR spring/summer-run Chinook Salmon, the minimum abundance thresholds are 2,000 spawners each in the Lemhi and Lower Mainstem SR; 1,000 spawners in the Lostine/Wallowa River, Upper Grande Ronde River, Catherine Creek, South Fork Mainstem, East Fork/Johnson Creek, Big Creek, Pahsimeroi, Upper Salmon East Fork, and Upper Salmon Mainstem; 750 in the Imnaha River Mainstem, Minam River, Wenaha, River, Secesh River, Bear Valley, Upper Mainstem North Fork, and Chamberlain Creek; and 500 in Camas Creek, Loon Creek, Marsh Creek, Lower Mainstem Middle Fork, Sulphur Creek, Valley Creek, Yankee Fork, and North Fork Salmon River (ICTRT 2007).

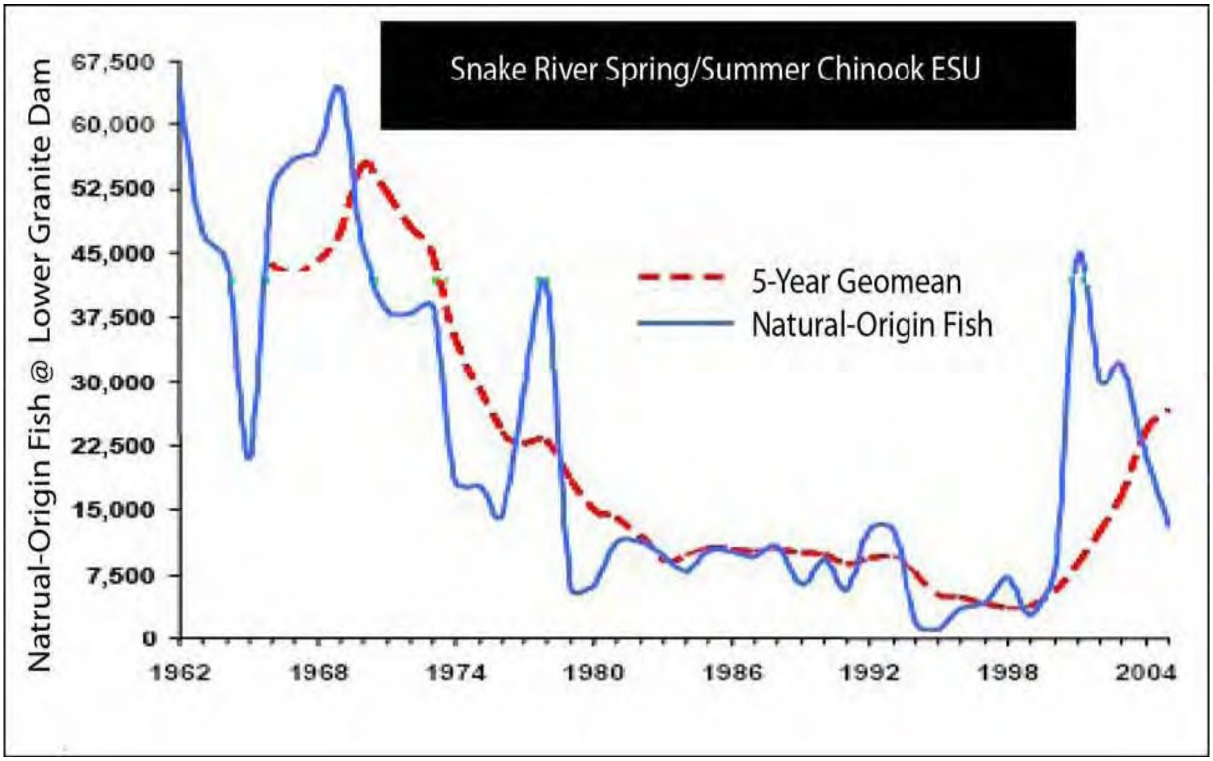

Figure 13. Snake River spring/summer-run Chinook Salmon ESU abundance trends (NMFS 2008b).

Lower Snake River MPG

Abundance and productivity remain the major concern for the Tucannon River population. Natural spawning abundance (10-year geometric mean) has increased but remains well below the minimum abundance threshold for the single extant population in this MPG. Poor natural productivity continues to be a major concern.

Grande Ronde/Imnaha MPG

The Wenaha River, Lostine/Wallowa River and Minam River populations showed substantial increases in natural abundance relative to the previous ICTRT review, although each remains below their respective minimum abundance thresholds. The Catherine Creek and Upper Grande Ronde populations each remain in a critically depressed state. Geometric mean productivity estimates remain relatively low for all populations in the MPG.

South Fork Salmon River MPG

Natural spawning abundance (10-year geometric mean) estimates increased for the three populations with available data series. Productivity estimates for these populations are generally higher than estimates for populations in other MPGs within the ESU. Viability ratings based on the combined estimates of abundance and productivity remain at high risk, although the survival/capacity gaps relative to moderate- and low-risk viability curves are smaller than for other ESU populations.

Middle Fork Salmon River MPG

Natural-origin abundance and productivity remains extremely low for populations within this MPG. As in the previous ICTRT assessment, abundance and productivity estimates for Bear Valley Creek and Chamberlain Creek (limited data series) are the closest to meeting viability minimums among populations in the MPG.

Upper Salmon River MPG

Abundance and productivity estimates for most populations within this MPG remain at very low levels relative to viability objectives. The Upper Salmon Mainstem has the highest relative abundance and productivity combination of populations within the MPG.

ESU Summary

Population-level status ratings remain at high risk across all MPGs in the ESU. Although recent natural spawning abundance has increased, all populations remain below minimum natural-origin abundance thresholds. Relatively low natural production rates and spawning levels below minimum abundance thresholds remain a major concern across the ESU. The ability of populations to be self-sustaining through normal periods of relatively low ocean survival remains uncertain. Factors cited in the 2005 and 2010 status reviews (Good et al. 2005, Ford et al. 2010) remain concerns or key uncertainties for several populations.

As a result of the current high risk facing this ESU’s component populations, the SR spring/summer Chinook Salmon MPGs do not meet the ICTRT viability criteria for the ESU (i.e., all five MPGs should be viable for the ESU to be viable). Therefore, the ESU is not currently considered to be viable. Overall, there is no new information to indicate an improvement in the biological risk category since the time of the 2010 status review. There is also no new information to indicate that this ESU’s extinction risk has increased considerably in the past 5 years. This ESU remains well distributed over 28 extant populations in three states. Total ESU abundance is depressed but not at critically low levels. Some populations have experienced increased abundance in the last 5 years. New information considered during the 2010 review confirms that this DPS remains at moderate risk of extinction.

While there have been improvements in abundance and productivity in several populations relative to prior reviews, those changes have not been sufficient to warrant a change in ESU status.

Snake River Fall Chinook Salmon

The NMFS listed SR fall-run Chinook Salmon as threatened on April 22, 1992 (57 FR 14653) and their threatened status was reaffirmed on June 28, 2005 (70 FR 37160). The ESU includes all naturally spawned populations of fall-run Chinook Salmon in the mainstem Snake River below Hells Canyon Dam, and in the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River subbasins. Four artificial propagation programs are considered to be part of the ESU—the Lyons Ferry Hatchery, Fall Chinook Acclimation Ponds Program, Nez Perce Tribal Hatchery, and Oxbow Hatchery fall-run Chinook hatchery programs (70 FR 37160).

For the purposes of reproduction, Salmon and steelhead typically exhibit a metapopulation structure (Schtickzelle and Quinn 2007, McElhany et al. 2000). Rather than interbreeding as one large aggregation, ESUs and DPSs function as a group of demographically independent populations separated by areas of unsuitable spawning habitat. For conservation and management purposes, it is important to identify the independent populations that make up an ESU or DPS. For the purposes of recovery planning and development of recovery criteria, the ICTRT identified independent populations for each SR ESA-listed species, and grouped them together into genetically similar major population groups (MPGs) (ICTRT 2003). The SR fall-run Chinook Salmon ESU has one MPG that is comprised of one extant population for the SR fall-run Chinook Salmon, the lower Snake River mainstem population. This population occupies the Snake River from its confluence with the Columbia River to Hells Canyon Dam, and the lower reaches of the Clearwater, Imnaha, Grande Ronde, Salmon, and Tucannon Rivers (ICTRT 2005). (Figure 14).

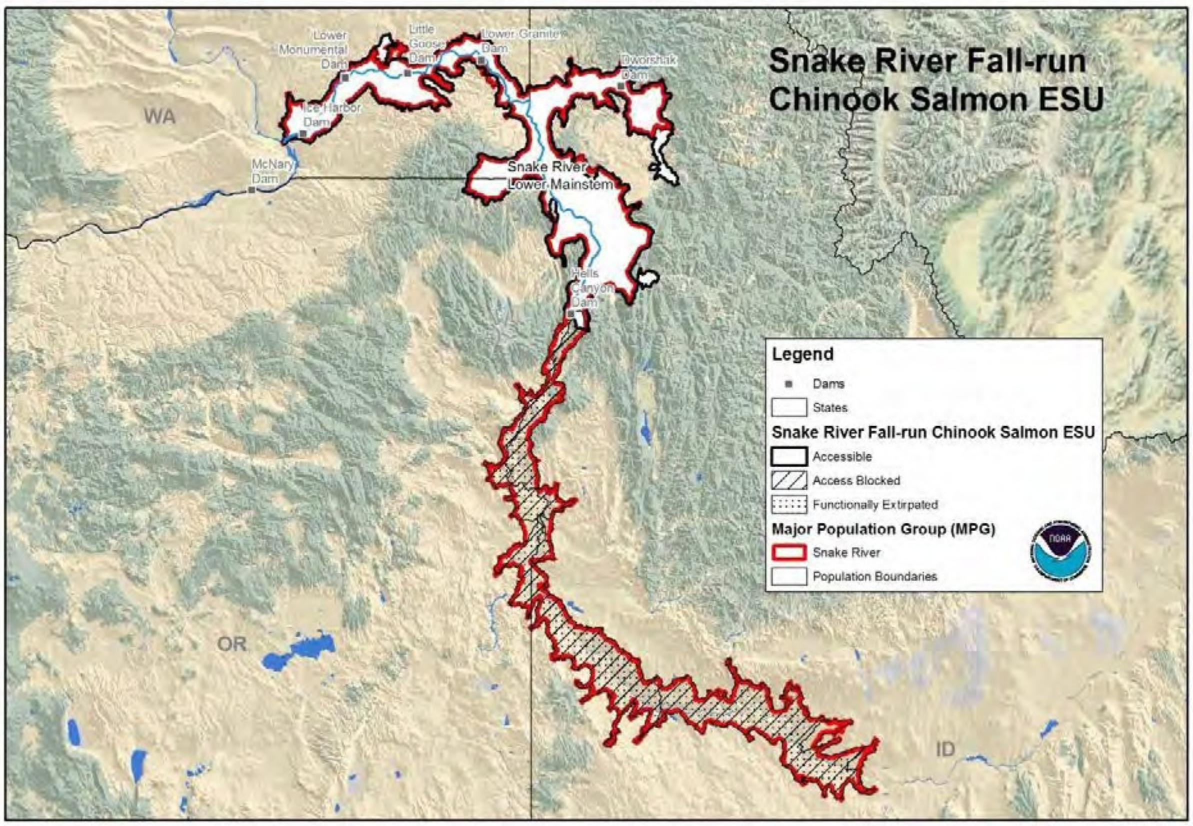

Figure 14. **Snake River Fall-run Chinook Salmon ESU population structure.**

Life History

Chapter 4 of the *Comprehensive Analysis* (Action Agencies 2007) contains additional information about the life history and population status of this ESU and is incorporated here by reference.

Fall-run Chinook Salmon in this ESU are ocean-type. Adults return to the Snake River at ages 2 through 5, with age 4 most common at spawning (Waples et al. 1991). Spawning takes place in

October through November and occurs in the mainstem Snake River and in the lower parts of major tributaries. Juveniles emerge from the gravels in March and April of the following year and move downstream from natal spawning and early rearing areas from June through early fall. Juvenile SR fall-run Chinook Salmon move seaward slowly as subyearlings, typically within several weeks of emergence (Waples et al. 1991). Scale samples from natural-origin SR fall-run Chinook Salmon taken at Lower Granite Dam continue to indicate that approximately half of the returns overwintered in freshwater. The majority of these fish are likely from the Clearwater River (Ford et al. 2010).

Snake River Fall Chinook MPG

SR fall-run Chinook Salmon are currently restricted to one extant population, the Lower Mainstem Snake River population, which occupies approximately 15 percent of the historical range of this ESU. The ICTRT considers the SR fall-run Chinook Salmon ESU to consist of one MPG, with three historical populations (only one of which is extant).

The two upstream populations (above the Hells Canyon hydropower complex), Marsing Reach and Salmon Falls, are extirpated. The extant Lower Mainstem population (below the Hells Canyon hydropower complex) is currently rated at moderate risk relative to ICTRT criteria. The ICTRT concluded that the single MPG must be at low risk (highly viable) for the ESU to be considered viable (ICTRT 2007). This would require the reestablishment of at least one other population to meet the minimum viability criteria established by the ICTRT for ESUs with a single MPG. The ICTRT recognized the difficulty of reestablishing fall-run Chinook Salmon populations and suggested initial recovery efforts emphasize improving the viability of the extant population, while creating the potential for reestablishment of an additional population (ICTRT 2007).

The Lower Mainstem population would be considered at low risk if the combination of abundance and productivity (geometric mean spawner to spawner ratios for parent escapements less than 2,000 spawners–75 percent of the minimum abundance threshold of 3,000) exceeds a viability curve generated by simulation modeling that incorporates observed year-to-year variability in return rates. In any case, the ICTRT criteria for low- viability risk stipulate that the 10-year geometric mean natural-origin escapement should exceed 3,000, with a minimum of 2,500 natural-origin spawners in the mainstem Snake River major spawning areas. Achieving a very low-risk rating for abundance and productivity requires exceeding the same natural-origin abundance threshold combined with a productivity estimate of 1.5 or higher. The ICTRT described five major spawning areas within the Lower Mainstem population–three mainstem reaches (Salmon River confluence to Hells Canyon Dam site, Lower Granite Dam to the Salmon River confluence, and the mainstem off of and including the lower Tucannon River), and two tributary mainstems (lower Grande Ronde River and the Clearwater River). In addition, the ICTRT defined smaller spawning reaches in the Imnaha River and the Salmon River as minor spawning areas.

Population Trends and Risks

The ICTRT completed a status review of SR fall-run Chinook Salmon and concluded that the species is “likely to become endangered” (Good et al. 2005). The ICTRT found moderate risk to the species for productivity and moderately high risks for abundance, spatial structure, and diversity. The ICTRT concluded that, although SR fall-run Chinook Salmon numbers have been increasing in recent years, there remains a moderately high risk of extinction due to insufficient abundance (Good et al. 2005). Sustained abundance of natural-origin fish at current levels or higher will decrease long-term risks to the species. Limiting factors identified for SR fall-run Chinook Salmon include: (1) Mainstem lower Snake and Columbia hydrosystem mortality; (2) degraded water quality; (3) reduced spawning and rearing habitat due to mainstem lower SR hydropower system; and (4) harvest impacts (NMFS 2005).

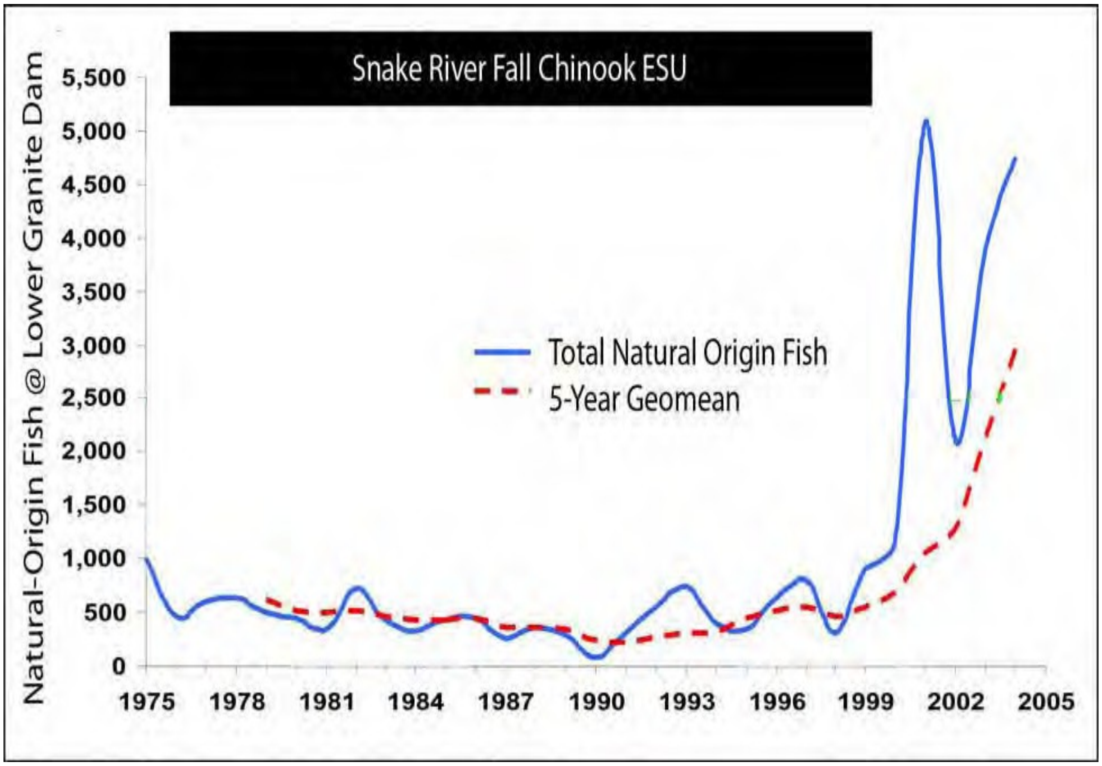

Figure 15. Snake River fall-run Chinook Salmon Evolutionarily Significant Unit Abundance trends (NMFS 2008b).

In March 2007, the ICTRT proposed minimum abundance thresholds for SR fall-run Chinook Salmon populations. They recommend a minimum long-term average spawning abundance threshold of 3,000 natural-origin spawners, with no fewer than 2,500 of those natural-origin spawners distributed in the mainstem Snake River habitat (ICTRT 2007).

ESU Summary

The Lower Mainstem Snake River fall Chinook Salmon population is the only extant population remaining from an ESU that historically also included a population upstream of the current location of the Hells Canyon Dam Complex. Abundance of this remaining population has increased substantially in recent years, and the recent increases in natural-origin abundance are encouraging. However, uncertainty remains regarding whether these abundance levels will be maintained, and improvements are needed in the species' productivity and diversity to achieve risk levels consistent with delisting (NWFSC 2015; NMFS 2015c).

Given the combination of current ratings of low risk for abundance/productivity and moderate risk for spatial structure/diversity summarized above, the Snake River fall-run Chinook Salmon ESU is rated at low risk relative to ICTRT criteria. The rating reflects ongoing uncertainty regarding the population's productivity, and whether recent increases in natural-origin abundance can be sustained over the long term. It also reflects concerns with the high levels of hatchery-origin spawners in natural spawning areas, and the potential for selective pressure imposed by current hydropower operations and cumulative harvest impacts. Overall, while new information indicates an improvement in ESU abundance, uncertainty about population productivity and diversity indicate that the biological risk category has not changed enough since the last status review to achieve the desired viability status of highly viable and support delisting (NWFSC 2015; NMFS 2015c).

Snake River Sockeye Salmon

NMFS listed SR Sockeye Salmon (*Oncorhynchus nerka*) as an endangered species on November 20, 1991 (56 FR 58619), and their endangered status was reaffirmed on June 28, 2005 (70 FR 37160). The ESU includes all anadromous and resident Sockeye Salmon from the Snake River basin (SRB), Idaho (extant populations occur only in the Stanley Basin), as well as residual Sockeye Salmon in Redfish Lake, Idaho, and one captive propagation hatchery program. Artificially propagated Sockeye Salmon from the Redfish Lake captive propagation program are considered part of the ESU. In 1993, NMFS determined that the residual population of SR Sockeye that exists in Redfish Lake is substantially reproductively isolated from kokanee (i.e., nonanadromous populations *of O. nerka* that become resident in lake environments over long periods of time), represents an important component in the evolutionary legacy of the biological species, and thus was included in the SR Sockeye ESU (70 FR 37160). The SR Sockeye Salmon hatchery program has not changed substantially from the previous ESA status review. Jones et al. (2011) did not recommend further review of this program.

There are five populations in this ESU (Figure 16). However, four historical populations are extirpated (Alturas Lake, Pettit Lake, Yellowbelly Lake, and Stanley Lake).

Therefore, the single extant historical population of SR Sockeye Salmon is currently restricted to Redfish Lake in the Sawtooth Valley. At the time of listing in 1991, the only confirmed population that belonged to this ESU was the beach-spawning population of Sockeye from Redfish Lake. Historical records indicate that Sockeye once occurred in several other lakes in the Stanley Basin but no adults were observed in these lakes for many decades and once residual Sockeye Salmon were observed, their relationship to the Redfish Lake population was uncertain (McClure et al. 2005). Since listing, progeny of Redfish Lake Sockeye have been outplanted to Pettit and Alturas lakes within the Sawtooth Valley.

The Stanley Basin and Sawtooth Valley lakes are relatively small compared to other lake systems that historically supported Sockeye production in the Columbia Basin. Stanley Lake is assigned to the smallest size category, along with Pettit and Yellowbelly Lakes. Redfish Lake and Alturas Lake fall into the next size category–intermediate. The average abundance targets recommended by the Snake River Recovery Team (Bevan et al. 1994) were incorporated as minimum abundance thresholds into a Sockeye viability curve. It was generated using historical age structure estimates from Redfish Lake sampling in the 1950s-1960s, and year-to-year variations in brood-year replacement rates generated from abundance series for Lake Wenatchee Sockeye. The minimum spawning abundance threshold is set at 1,000 for the Redfish and Alturas Lake populations (intermediate category), and at 500 for populations in the smallest historical size category (e.g., Alturas and Pettit Lakes). The ICTRT recommended that long-term recovery objectives should include restoring at least three of the lake populations in the ESU to viable or highly viable status.

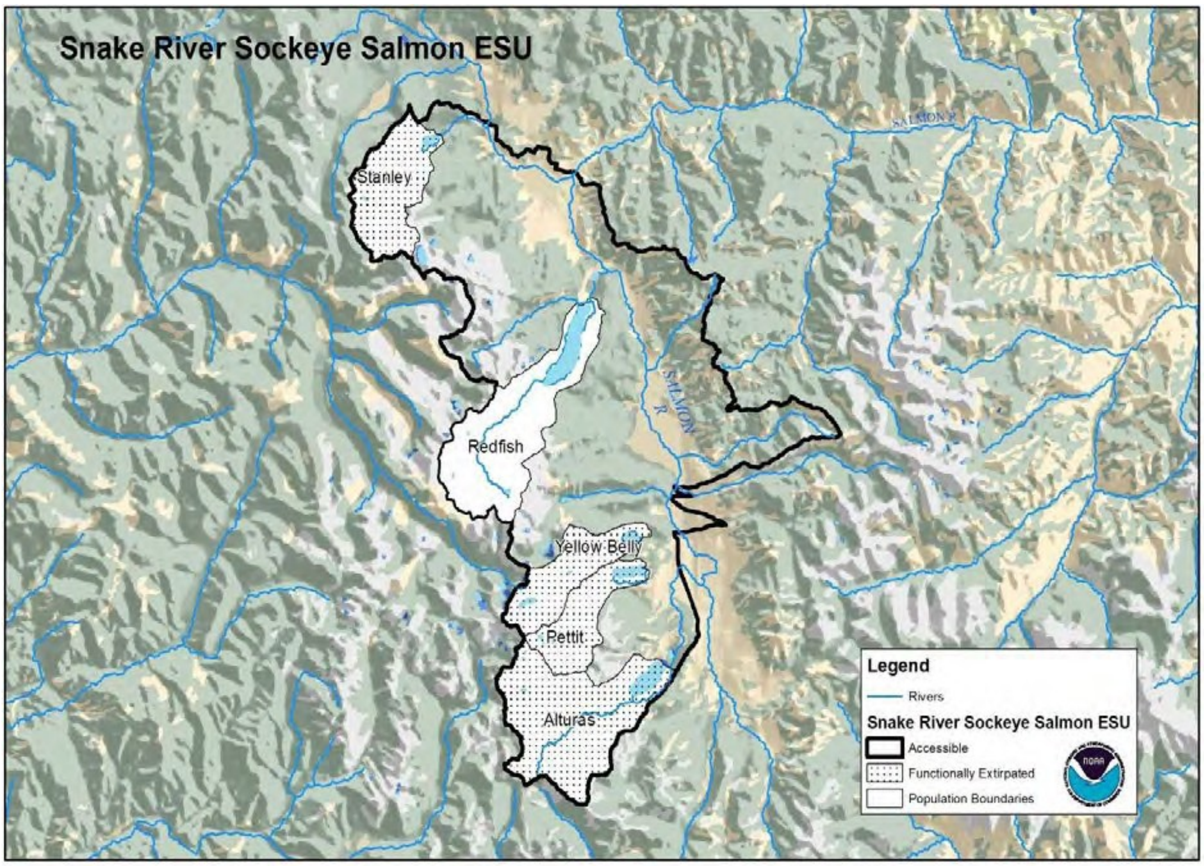

Figure 16. **Snake River Sockeye Salmon ESU population structure.**

Life History

Chapter 6 of the *Comprehensive Analysis* (Action Agencies 2007) contains additional information about the life history and population status of this ESU and is incorporated here by reference.

Snake River Sockeye Salmon adults enter the Columbia River primarily during June and July. Arrival at Redfish Lake, which now supports the only remaining run of SR Sockeye Salmon, usually occurs in August, and spawning occurs primarily in October (Bjornn et al. 1968). Eggs hatch in the spring between 80 and 140 days after spawning. Fry remain in the gravel for 3 to 5 weeks, emerge in April through May, and move immediately into the lake. Once there, juveniles feed on plankton for 1 to 3 years before they migrate to the ocean. Migrants leave Redfish Lake from late April through May (Bjornn et al. 1968) and travel almost 900 miles to the Pacific Ocean. Smolts reaching the ocean remain inshore or within the influence of the Columbia River plume during the early summer months. SR Sockeye Salmon usually spend 2 to 3 years in the Pacific Ocean and return in their fourth or fifth year of life.

Snake River Sockeye Salmon are unique. Sockeye Salmon returning to Redfish Lake in Idaho's Stanley Basin travel a greater distance from the sea (approximately 900 miles) to a higher elevation (6,500 feet) than any other Sockeye Salmon population and are the southern-most population of Sockeye Salmon in the world (Bjornn et al. 1968). Stanley Basin Sockeye Salmon are separated by 700 or more river miles from two other extant upper Columbia River populations in the Wenatchee River and Okanogan River drainages. These latter populations return to lakes at substantially lower elevations (Wenatchee at 1,870 feet, Okanogan at 912 feet) and occupy different ecoregions.

Five lakes in the Stanley Basin historically contained Sockeye Salmon—Alturas, Pettit, Redfish, Stanley, and Yellowbelly (Bjornn et al. 1968). It is generally believed that adults were prevented from returning to the Sawtooth Valley from 1910 to 1934 by Sunbeam Dam. Sunbeam Dam was constructed on the Salmon River approximately 20 miles downstream of Redfish Lake. Whether or not Sunbeam Dam was a complete barrier to adult migration remains unknown. It has been hypothesized that some passage occurred while the dam was in place, allowing the Stanley Basin population to persist (Bjornn et al. 1968, Waples 1991). Adult returns to Redfish Lake during the period of 1954 through 1966 ranged from 11 to 4,361 fish (Bjornn et al. 1968). Sockeye Salmon in Alturas Lake were extirpated in the early 1900s as a result of irrigation diversions, although residual Sockeye may still exist in the lake (Chapman and Witty 1993). From 1955-1965, the Idaho Department of Fish and Game eradicated Sockeye Salmon from Pettit, Stanley, and Yellowbelly lakes, and built permanent structures on each of the lake outlets that prevented reentry of anadromous Sockeye Salmon (Chapman and Witty 1993). In 1985, 1986, and 1987, 11, 29, and 16 Sockeye, respectively, were counted at the Redfish Lake weir (Good et al. 2005). Only 18 natural-origin Sockeye Salmon have returned to the Stanley Basin since 1987. The first adult returns from the captive brood stock program returned to the Stanley Basin in 1999. From 1999 through 2005, a total of 345 captive brood program adults that had migrated to the ocean returned to the Stanley Basin.

Population Trends and Risk

NMFS proposed an interim recovery level of 2,000 adult SR Sockeye Salmon in Redfish Lake and two other lakes in the Snake River basin. Limiting factors identified for SR Sockeye include: (1) Reduced tributary streamflow; (2) impaired passage; and (3) mainstem lower Columbia hydropower system mortality (NMFS 2005).

ESU Summary

The Sockeye captive broodstock program has met its initial objectives by preventing the extinction of the ESU in the short term and preventing any further loss of genetic diversity. In recent years, the numbers of returning adults have exceeded those needed for broodstock collection. Therefore, the program has initiated efforts to evaluate alternative supplementation strategies in support of reestablishing natural production of anadromous Sockeye. These include releasing adults to spawn naturally, planting boxes with eyed-eggs for incubation and early rearing, and releasing hatchery-reared smolts for volitional emigration from the Sawtooth Valley lakes. Limnological studies are being conducted to determine production potentials in three of the Sawtooth Valley lakes that are candidates for Sockeye restoration. The Corps of Engineers was able to initiate studies of survival of marked SR Sockeye smolts through the mainstem Federal Columbia River Power System (FCRPS) in 2010. Prior to this, the survival of unlisted Sockeye from the Upper Columbia ESU through the lower Columbia reach has been extrapolated to the Snake River to estimate the relative effectiveness of in river improvements (e.g., surface bypass) versus transport operations in supporting efforts to increase the viability of the ESU. Although the captive brood program has been successful in providing substantial numbers of hatchery Sockeye for supplementation efforts, reestablishing sustainable natural production will require substantial increases in survival rates across all life-history stages. The increased abundance of hatchery reared SR Sockeye reduces the risk of immediate extinction, but levels of naturally produced Sockeye returns remain extremely low.

Although the status of the SR Sockeye Salmon ESU appears to be improving, this ESU remains at a high risk of extinction. Recent returns are still a fraction of historic abundance and substantial increases in survival rates across all life-history stages must occur in order to reestablish sustainable natural production. The new information considered does not indicate a change in the biological risk category since the time of the last status review (Ford et al 2010).

Snake River Basin Steelhead

The NMFS listed SR steelhead as a threatened species on August 18, 1997 (62 FR 43937), and protective regulations were issued under Section 4(d) of the ESA on July 10, 2000 (65 FR 42422). Their threatened status was reaffirmed on June 28, 2005 (70 FR 37160). The DPS includes all naturally spawned steelhead populations below natural and manmade impassable barriers in streams in the Snake River basin of southeast Washington, northeast Oregon, and Idaho. Six artificial propagation programs are considered part of the DPS—the Tucannon River, Dworshak NFH, Lolo Creek, North Fork Clearwater, East Fork Salmon River, and the Little Sheep Creek/Imnaha River Hatchery steelhead hatchery programs (71 FR 834). The ICTRT (2007) identified 26 populations in the following six MPGs for this species—Clearwater River, Grande Ronde River, Hells Canyon, Imnaha River, Lower SR, and Salmon River. The North Fork population in the Clearwater River is extirpated. The ICTRT noted that SRB steelhead remain spatially well distributed in each of the six major geographic areas in the SRB (Good et al. 2005). Environmental conditions are generally drier and warmer in these areas than in areas occupied by other steelhead species in the Pacific Northwest. Snake River basin steelhead were blocked from portions of the upper SR beginning in the late 1800s and culminating with the construction of Hells Canyon Dam in the 1960s.

For the purposes of reproduction, Salmon and steelhead typically exhibit a metapopulation structure (Schtickzelle and Quinn 2007, McElhany et al. 2000). Rather than interbreeding as one large aggregation, ESUs and DPSs function as a group of demographically independent populations separated by areas of unsuitable spawning habitat. For conservation and management purposes, it is important to identify the independent populations that make up an ESU or DPS. For the purposes of recovery planning and development of recovery criteria, the ICTRT identified independent populations for each SR ESA-listed species, and grouped them together into genetically similar major population groups (MPGs) (ICTRT 2003). The SR steelhead DPS is comprised of five extant MPGs with 24 extant populations—Clearwater River, Grande Ronde River, Imnaha River, Lower Snake River, and the Salmon River (Figure 17). The SR basin steelhead DPS also includes the Hells Canyon Tributaries MPG but does not contain an extant population and therefore is not expected to contribute to recovery of the DPS. This DPS consists of A-run steelhead which primarily return to spawning areas beginning in the summer and the larger sized B-run steelhead which begin the migration in the fall.

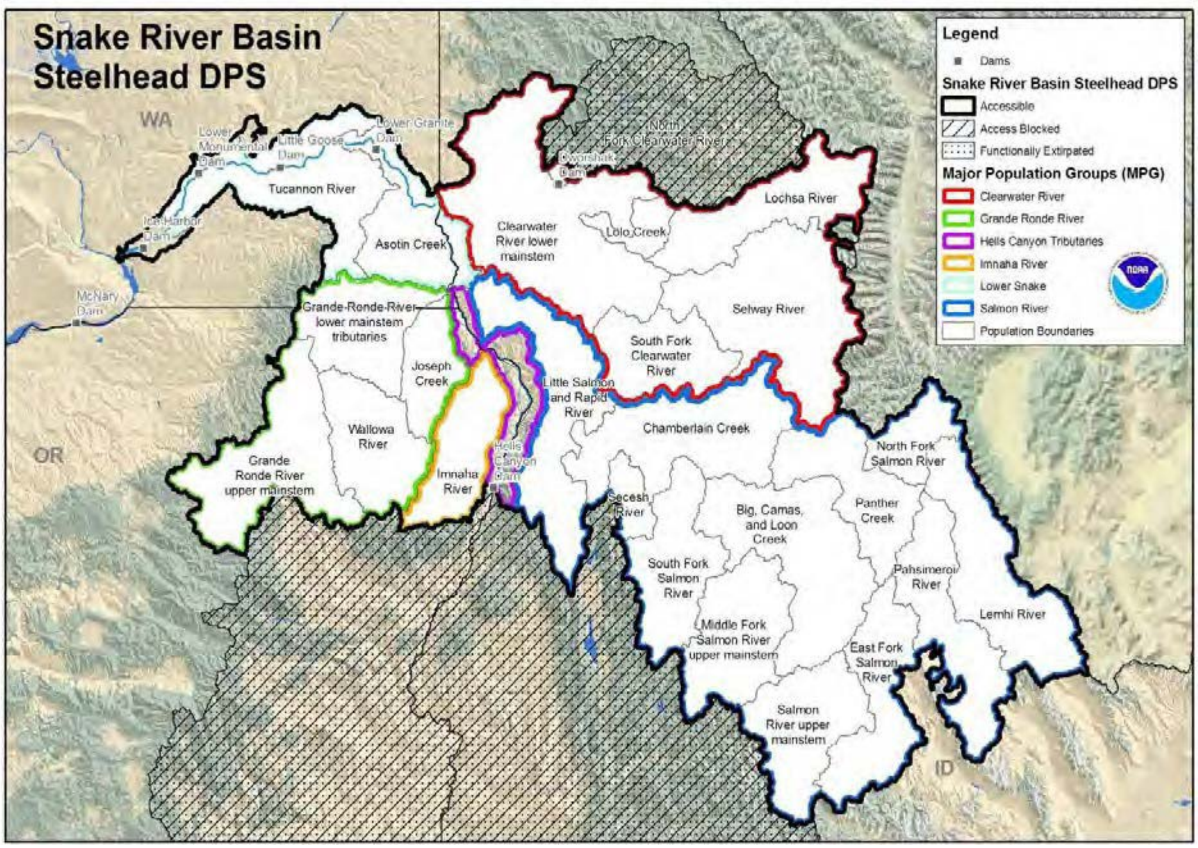

Figure 17. **Snake River steelhead DPS population structure.**

Life History

Chapter 7 of the *Comprehensive Analysis* (Action Agencies 2007) contains additional information about the life history and population status of this ESU and is incorporated here by reference.

The Snake River steelhead ESU is distributed throughout the Snake River drainage system, including tributaries in southeast Washington, eastern Oregon, and north/central Idaho. Snake River steelhead migrate a substantial distance from the ocean (up to 930 miles) and use high-elevation tributaries (typically 3,300-6,600 feet above sea level) for spawning and juvenile rearing. Snake River steelhead occupy habitat that is considerably warmer and drier (on an annual basis) than other steelhead ESUs.

Snake River basin steelhead are generally classified as summer run, based on their adult run timing patterns. Summer steelhead enter the Columbia River from late June to October. After holding over the winter, summer steelhead spawn during the following spring (March to May). Managers classify upriver summer steelhead runs into two groups based primarily on ocean age and adult size upon return to the Columbia River. Those classified as A-run steelhead are predominately age-1 ocean fish, while B-run steelhead are larger, predominately age-2 ocean fish.

Unlike other anadromous *Oncorhynchus* species, some adult steelhead survive spawning, return to the sea, and later return to spawn a second time. After hatching, juvenile SR steelhead typically spend 2-3 years in freshwater before they smolt and migrate to the ocean, primarily between April and June. The SR steelhead B-run population levels remain particularly depressed.

Population Trends and Risks

The primary concern regarding SR steelhead identified in the 1998 status review was a sharp decline in natural stock returns beginning in the mid- 1980s. Nine of 13 trend indicators were in decline in the mid-1980s, while 4 were increasing. In addition, Idaho Department of Fish and Game (IDFG) parr survey data indicated declines for both A-run and B-run steelhead in wild and natural stock areas.

The high proportion of hatchery fish in the run was also identified as a concern, particularly because of the lack of information on the actual contribution of hatchery fish to natural spawning. The review recognized that some wild spawning areas have relatively little hatchery spawning influence including the Selway, lower Clearwater, and Middle, South Fork, and lower Salmon rivers. In other areas, such as the upper Salmon River, there is likely little or no natural production of locally native steelhead. The review identified threats to genetic integrity from past and present hatchery practices as a concern. A concern for the North Fork Clearwater stock was also identified. The stock is currently maintained through the Dworshak Hatchery program since Dworshak Dam blocks upstream migration. The 1998 review also highlighted concerns for widespread habitat degradation and flow impairment throughout the SRB and for substantial modification of the seaward migration corridor by hydroelectric power development on the Snake and mainstem Columbia rivers (Good et al. 2005). Limiting factors identified for the SRB steelhead include: (1) Mainstem lower Snake and Columbia River hydrosystem mortality; (2)

reduced tributary streamflow; (3) altered tributary channel morphology; (4) excessive fine sediment in tributaries; (5) degraded tributary water quality; and (6) harvest- and hatchery-related adverse effects (NMFS 2005).

In March 2007, the ICTRT proposed minimum abundance thresholds for SRB steelhead populations. They represent the numbers that, taken together, may be needed for the population to be self-sustaining, or recovered, in its natural ecosystem. For SRB steelhead, the minimum abundance thresholds are 1,500 spawners each in the Upper Grande Ronde River and Lower Mainstem SR; 1,000 spawners in the Tucannon, Wallowa, Lower Grande Ronde, Imnaha, Selway, South Fork Salmon, Lochsa, Lemhi, Upper Salmon East Fork, Upper Salmon, Upper Middle Fork, Lower Middle Fork, Pahsimeroi, and Little Salmon rivers; and 500 spawners in the Asotin River, Joseph Creek, Lolo Creek, Chamberlain Creek, Panther Creek, Secesh River, and North Fork Salmon River (ICTRT 2007).

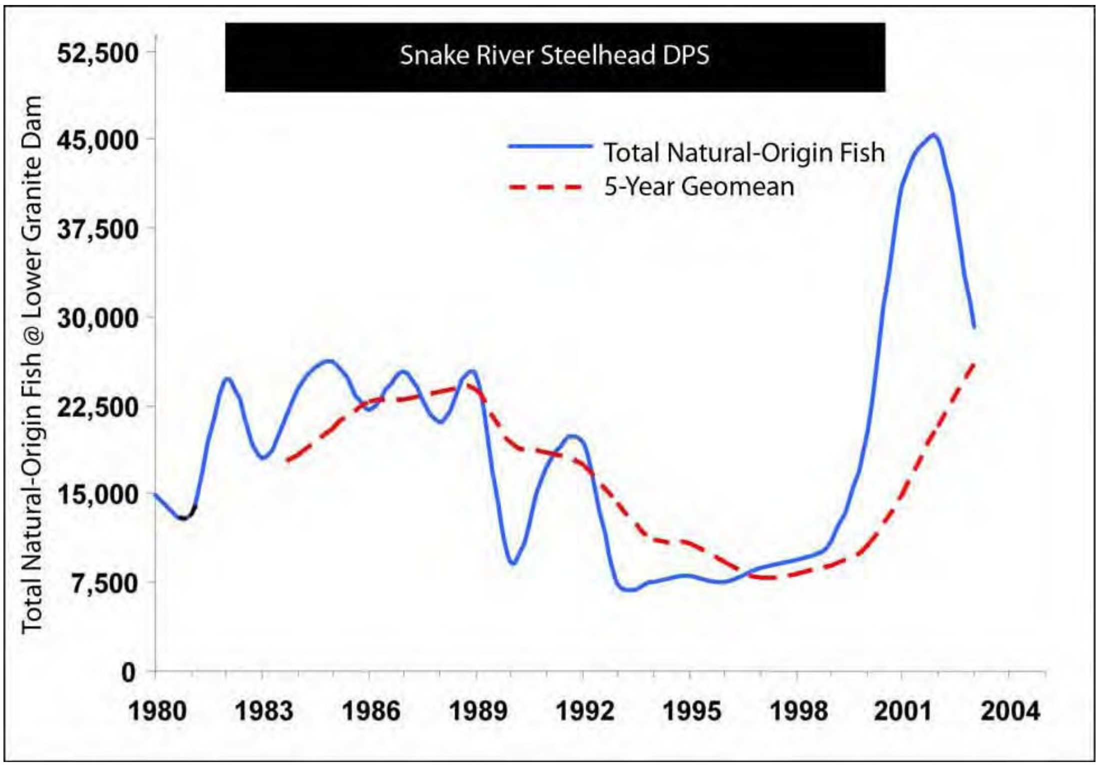

Figure 18. Snake River basin Steelhead Distinct Population Segment Abundance trends (NMFS 2008b).

Clearwater River MPG

This MPG includes five extant and one extirpated (North Fork Clearwater River) populations. Three populations must meet viability criteria, one of which must meet the criteria for high viability. There are three populations that must achieve viable status, including the Clearwater lower mainstem (the only A-run life-history type), Lolo Creek (the only A/B-run life-history type) and South Fork Clearwater (the only intermediate- size population). Additionally, either the Lochsa River or Selway River population must be viable for the MPG to be considered viable, since the ICTRT criteria require at least two of the three large-size populations to be viable.

Because the predominant historic production was from fish of B-run type life-history strategy and the entire North Fork Clearwater drainage is blocked to that type of production, the recovery planning objective in this MPG is to achieve viable status for the Lochsa River population. The Lochsa River population was selected because of greater ability to assess status using current monitoring programs. Those four populations that currently occupy historical habitat must be rated as viable for the MPG to be considered viable. All the remaining extant populations should be at a "maintained" status.

Grande Ronde River MPG

Two of the four populations must achieve viable status to meet the ICTRT criteria for this MPG. In addition, at least one of these populations must be rated as highly viable. The ICTRT example scenario includes the Upper Grande Ronde River (large-size population), and either Joseph Creek (currently low-risk status) or the Lower Grande Ronde River be at viable status for the MPG to be rated viable.

Hells Canyon Tributaries MPG

This MPG historically contained three independent populations. However, all three of these populations were above Hells Canyon Dam (Powder River, Burnt River and Weiser River) and are now extirpated. A small number of steelhead occupy some tributaries below Hells Canyon Dam; however, none of these tributaries (nor all combined) appear to be large enough to support an independent population. Based on the extirpated status of populations in the MPG, it is not expected to contribute to recovery of the DPS.

Imnaha River MPG

This MPG contains one population. The Imnaha River population should meet highly viable status for this MPG to be rated as viable under the basic ICTRT criteria.

Lower Snake MPG

The Lower Snake MPG contains two populations. The ICTRT recommends that both populations (Tucannon River and Asotin Creek) be restored to viable status, with at least one meeting the criteria for highly viable.

Salmon River MPG

This relatively large MPG includes 12 extant populations. Two populations are characterized as large-size, ten are intermediate-size, and two are basic-size populations. The ICTRT recommends a minimum of six populations, at least four of which are intermediate-size and one large-size, and be at viable status for the MPG to be viable. At least one of the minimum six populations must be highly viable. The initial recovery planning objective targets the South Fork Salmon River, Secesh River, Chamberlain Creek, and Upper Middle fork Salmon River populations to achieve viable status for the MPG. The South Fork Salmon River population was selected because of its genetic distinctiveness, historic B-run production potential, and lack of hatchery influence or effects. The Chamberlain Creek population (which includes fish spawning in French, Sheep, Crooked, Bargamin, and Sabe Creeks, the Wind River, and Chamberlain

Creek) was delineated on the basis of life history and basin topography. All streams in this population are classified as supporting A-run steelhead. The Chamberlain Creek population was selected to represent wild A-run steelhead life-history strategy in the MPG. The Secesh River population, which includes the mainstem Secesh and its tributaries, is identified in the recovery planning objective because of its genetic distinctiveness, historic B-run production potential and lack of hatchery influence or effects. The Upper Middle Fork Salmon River population was selected because of its lack of hatchery influence and geographic separation from the previous three populations. At least two of the remaining populations must be rated viable for the Salmon River MPG to be rated viable.

DPS Summary

The viability ratings of the component populations in the Snake River steelhead DPS do not currently meet the ICTRT viability criteria for the DPS; the five MPGs should be at viable status for the DPS to be viable. Due to the high-risk population ratings, uncertainty about the viability status of many populations, and overall lack of population data, none of the MPGs are considered to be viable. Therefore, the DPS is not currently considered to be viable.

The level of natural production in the two populations with full data series and the Asotin Creek index reaches is encouraging, but the status of most populations in this DPS remains highly uncertain. Population-level natural-origin abundance and productivity inferred from aggregate data and juvenile indices indicate that many populations are likely below the minimum combinations defined by the ICTRT viability criteria. There is little evidence for substantial change in DPS viability relative to the previous status review. Although direct biological performance measures for this DPS indicate little realized progress to date toward meeting its recovery criteria, there is no new information to indicate that its extinction risk has increased significantly. The DPS remains well distributed throughout its current range in the Snake River basin and at least some populations are considered to be viable. Overall, the new information considered does not indicate a change in the biological risk category since the time of the 2010 status review (Ford et al. 2010). This DPS remains at moderate risk of extinction.

Designated Critical Habitat for Columbia Basin Salmon and Steelhead

The ESA requires NMFS to designate critical habitat, to the maximum extent prudent and determinable, for species it lists under the ESA. Critical habitat is defined as:

(1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species at the time of listing if the agency determines that the area itself is essential for conservation.

NMFS has designated critical habitat for salmon and steelhead species that may be affected by the proposed action. Critical habitat includes the stream channels within the designated stream reaches, and extends laterally to the ordinary high-water line. In areas where ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. Critical habitat in lake areas is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of ordinary high water, whichever is greater. In estuarine and nearshore marine areas, critical habitat includes areas contiguous with the shoreline from the line of extreme high water out to a depth no greater than 30 meters relative to mean lower low water. Within these areas, the primary constituent elements (PCEs) essential for the conservation of the listed species are those sites and habitat components that support one or more life stages.

Critical habitat was designated for the Snake River basin steelhead DPS and all other listed upper Columbia River, middle Columbia River, lower Columbia River (except Coho Salmon), and Willamette River anadromous salmonid ESUs and DPSs in September 2005 (70 FR 52630). Designation of critical habitat for the Lower Columbia River Coho Salmon ESU is currently under development by NMFS. Critical habitat was designated for Snake River spring/summer Chinook Salmon, Snake River fall Chinook Salmon, and Snake River Sockeye Salmon in December 1993 (58 FR 68543) and revised for Snake River spring/summer Chinook Salmon in October 1999 (64 FR 57399).

PCEs

As part of the designation process, NMFS convened Critical Habitat Analytical Teams (CHARTs) to evaluate the current status of the ESU's habitat and identify threats to habitat health. The Lower and Upper Columbia River CHART's assessment reports are available at NMFS' website at http://www.nwr.noaa.gov/Salmon-Habitat/Critical- Habitat/2005-Biological-Teams-Report.cfm. In determining which areas should be critical habitat, the CHARTs identified the primary constituent elements (PCEs) that are essential for the conservation of the species. PCEs for these ESUs and DPSs are those sites and habitat components that support one or more life stages, including freshwater spawning sites, (2) freshwater rearing sites, and (3) freshwater migration corridors. The ESUs addressed in the final critical habitat rule (70 FR 52630) and CHART reports share many of the same rivers and estuaries and have similar life-history characteristics and, therefore, many of the same PCEs. These PCEs include sites essential to support one or more life stages of the ESU (sites for spawning, rearing, migration and foraging). These sites, in turn, contain physical or biological features essential to the conservation of the ESU (for example, spawning gravels, water quality and quantity, side channels, forage species).

NMFS (NMFS 2005b) has identified the following PCEs for the nine ESUs and DPSs of Columbia Basin salmonids that were designated in 2005 (70 FR 52630):

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development. These features are essential to conservation because without them, the species cannot successfully spawn and produce offspring.

2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. These features are essential to conservation because without them, juveniles cannot access and use the areas needed to forage, grow, and develop behaviors (e.g., predator avoidance, competition) that help ensure their survival.
3. Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival. These features are essential to conservation because without them, juveniles cannot use the variety of habitats that allow them to avoid high flows, avoid predators, successfully compete, begin the behavioral and physiological changes needed for life in the ocean, and reach the ocean in a timely manner. Similarly, these features are essential for adults because they allow fish in a nonfeeding condition to successfully swim upstream, avoid predators, and reach spawning areas on limited energy stores.
4. Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation. These features are essential to conservation because without them, juveniles cannot reach the ocean in a timely manner and use the variety of habitats that allow them to avoid predators, compete successfully, and complete the behavioral and physiological changes needed for life in the ocean. Similarly, these features are essential to the conservation of adults because they provide a final source of abundant forage that will provide the energy stores needed to make the physiological transition to freshwater, migrate upstream, avoid predators, and develop to maturity upon reaching spawning areas.
5. A fifth category in NMFS (NMFS 2005b), “nearshore marine areas,” refers to areas designated in Puget Sound (i.e., is not applicable to Columbia Basin salmonids).

The CHART identified habitat-related human activities that affect PCE quantity and/or quality. The primary categories of habitat-related activities identified by the CHART are (1) forestry, (2) agriculture, (3) channel modifications/diking, (4) road building/ maintenance, (5) urbanization, (6), dams, (7) irrigation impoundments and withdrawals, and (8) wetland loss/removal. All of these activities have PCE-related impacts because they have altered one or more of the following: stream hydrology, flow and water-level modifications, fish passage, geomorphology and sediment transport, temperature, dissolved oxygen, vegetation, soils, nutrients and chemicals, physical habitat structure, and stream/estuarine/marine biota and forage (NMFS CHART 2005).

At the time of the critical habitat designations that became final in September 2005, NMFS' CHARTs rated 525 occupied watersheds in the Columbia River Basin. The CHARTs gave each of these occupied watersheds a high, medium, or low rating. High- value watersheds are those with a high likelihood of promoting conservation, while low value watersheds are expected to contribute relatively little. Of the 525 watersheds evaluated, 382 were assigned a high rating, 93 a medium rating, and 50 a low rating.

Many of the high value watersheds encompassed the mainstem Columbia River migration corridor due to its importance to both juvenile and adult salmon and steelhead populations. The CHART reports all noted that, "After reviewing the best available scientific data for all of the areas within the freshwater and estuarine range of Columbia River Basin salmon and steelhead, the CHART concluded that the Columbia River corridor was of high conservation value to the respective ESUs and DPSs. The CHART reports noted that this corridor connects every watershed and population with the ocean and is used by rearing/migrating juveniles and migrating adults. The Columbia River estuary is a particularly important area for salmon and steelhead as both juveniles and adults make the critical physiological transition between life in freshwater and marine habitats" (ISAB 2000, Marriott et al. 2002).

Upper Columbia River Spring Chinook

The Columbia River rearing and migration corridor consists of that segment from Rock Island Dam downstream to the Pacific Ocean. Rock Island Dam is located near the downstream border of the Entiat River, which was the furthest downstream HUC5 with spawning or tributary PCEs identified in the range of this ESU. Fish distribution and habitat use data from WDFW identify approximately 448 miles of occupied riverine and estuarine habitat in this corridor (WDFW 2003). This corridor overlaps with the following counties: Clatsop, Columbia, Gilliam, Hood River, Morrow, Multnomah, Sherman, Umatilla, and Wasco counties in Oregon; and Benton, Chelan, Clark, Cowlitz, Douglas, Franklin, Grant, Kittitas, Klickitat, Skamania, Wahkiakum, Walla Walla, and Yakima counties in Washington.

Upper Columbia River Steelhead

The Columbia River rearing and migration corridor consists of that segment from the confluence of the Yakima and Columbia rivers downstream to the Pacific Ocean. This confluence is located in the Columbia River/Zintel Canyon HUC5, which was the furthest downstream HUC5 with spawning or tributary PCEs identified in the range of this ESU. Fish distribution and habitat use data from WDFW identify approximately 331 miles of occupied riverine and estuarine habitat in this corridor (WDFW 2003). This corridor overlaps with the following counties: Clatsop, Columbia, Gilliam, Hood River, Morrow, Multnomah, Sherman, Umatilla, and Wasco counties in Oregon; and Benton, Clark, Cowlitz, Franklin, Klickitat, Skamania, Wahkiakum, and Walla Walla counties in Washington.

Middle Columbia River Basin steelhead

The Columbia River rearing and migration corridor consists of that segment from the confluence of the Wind and Columbia rivers downstream to the Pacific Ocean. This confluence is located at the downstream boundary of the Middle Columbia/Grays Creek HUC5 which was the furthest downstream HUC5 with spawning or tributary PCEs identified in the range of this ESU. Fish distribution and habitat use data from ODFW and WDFW identify approximately 151 miles of occupied riverine and estuarine habitat in this corridor (ODFW 2003a; ODFW 2003b; WDFW 2003). This corridor overlaps with the following counties: Clatsop, Columbia, Gilliam, Hood River, Morrow, Multnomah, Sherman, Umatilla, and Wasco counties in Oregon; and Benton, Clark, Cowlitz, Franklin, Klickitat, Skamania, Wahkiakum, and Walla Walla counties in Washington.

Snake River Spring/Summer Chinook, Fall Chinook, and Sockeye Salmon

Critical habitat was also designated for the Columbia River mainstem migration corridor for each of these ESUs as follows: "The Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) and including all Columbia River estuarine areas and river reaches proceeding upstream to the confluence of the Columbia and Snake River." Because the PPL 5.8WW will have no effect to critical habitat areas in the Snake River basin outside of the Columbia River migration corridor, this BA will not list those critical habitat areas or discuss them further. The effects analysis below will only analyze the effects on the Columbia River migration corridor critical habitat only for the Snake River basin ESUs.

Snake River Basin Steelhead

The lower Snake/Columbia River rearing and migration corridor begins in southeast Washington immediately downstream of the confluence of the Snake River with the Palouse River. The corridor includes approximately 58 miles of the Lower Snake River and 320 miles of the Columbia River. Watersheds between the Palouse River to the Columbia/Snake River confluence are outside of the spawning range of this ESU and likely used in a limited way as juvenile rearing habitat for this ESU.

Effects Determination

Effects to Fish Species

Operation of PPL 5.8 will result in direct return flow to the Columbia River. This flow will occur during irrigation season (generally March to October). The flow range will differ between normal operations and emergency situations. During normal operations, return flow will be between 1-5 cubic feet per second (cfs) to the Columbia River. Emergency situations will result in up to 88 cfs of return flow until remedied (usually a few hours). Return flows for emergency situations are shown in below (Table 1). Even if PPL5.8 WW spills 88 cfs for a prolonged period of time (even the duration of irrigation season), the effects are expected to be insignificant to fish species. Contributions of flow will not exceed 0.1 of a percent of Columbia River average discharge below Priest Rapids Dam.

Table 1. Maximum potential discharge of PPL 5.8 as a percentage of Columbia River discharge.

Season	PPL 5.8WW Maximum Discharge (CFS)	Columbia River Average Discharge (CFS)	PPL 5.8WW Discharge as a Percentage of the Columbia River
2012	88	176,652	0.05
2013	88	135,830	0.06
2014	88	135,349	0.07
2015	88	103,418	0.09
2016	88	116,159	0.08

The 38 turbidity samples taken from 2012 - 2016 at the existing PPL 4.4 WW location, 1.4 miles upstream, had a median value of 3.9 nephelometric turbidity unit (NTU). However, 90 percent of turbidity levels were below 8.5 NTUs. The highest value sampled was 32.5 NTUs in the 2012 season and was caused by a rain event (SCBID 2016). There are no anticipated effects to water quality from the operation of PPL 5.8.

There may be short-term increases in turbidity during construction of the PPL 5.8 flume, work platform and riprap placement if water is present. Sediment concerns created by construction and removal of vegetation will be minimized by placement of a turbidity curtain or hay bales and silt fence. The area will be isolated from fish prior to construction if necessary. Localized turbidity effects are expected to last only for a few hours after work is complete. However, it is likely that work will be completed in dry conditions. Riprap is expected to be placed in the dry.

For salmonids, turbidity elicits a number of behavioral and physiological responses (i.e., gill flaring, coughing, avoidance, increase in blood sugar levels) which indicate some level of stress (Bisson and Bilby 1982, Sigler *et al.* 1984, Berg and Northcote 1985, Servizi and Martens 1992). The magnitude of these stress responses is generally higher when turbidity is increased and particle size decreased (Bisson and Bilby 1982, Servizi and Martens 1987, Gregory and Northcote 1993). Although turbidity may cause stress, Gregory and Northcote (1993) have shown that moderate levels of turbidity (35-150 NTU) accelerate foraging rates among juvenile Chinook Salmon, likely because of reduced vulnerability to predators (camouflaging effect).

Proposed project timing for the construction of the PPL 5.8 wasteway will occur during the fall and winter months (November through February), which is the time when no adult salmonids are observed in the action area and few juvenile salmonids are anticipated to be present (Easterbrooks 1995-1999, Mesa and Magie 2003, Zimmerman and Rasmussen 1981).

Installation of the flume, work platform and riprap placement could result in effects to juvenile fish that are in the proposed project area. Mechanical dumping of gravel/riprap and compaction along with subsequent movement of material could conceivably lead to physical injury or disturbance to fish that occupy aquatic habitat areas that are near the construction location. However, the likelihood of entrainment and harassment will be reduced by completing construction in the winter (November through February) when water levels are low and listed salmonids are not expected to be present in high densities and isolation of the work area.

Effects to Critical Habitat

Operational use of PPL 5.8WW will result in an insignificant amount of return flow to the Columbia River. This water currently returns to the Columbia River after infiltrating the soil beneath Adam's Pond. Water quality and quantity effects are expected to be insignificant.

Construction of PPL 5.8WW will result in the removal of some streamside vegetation. It is estimated that up to 5 nonnative trees (<12 inch diameter) will be removed in addition to shrubs and grasses along 60 feet of streambank (Figure 19). The site will be replanted with native shrubs and grasses after completion. There could be localized effects to critical habitat but it will be insignificant as the current vegetation is not overhanging and is likely not affecting temperatures or shade due to its location on the streambank.

Sediment generated by construction of the project will settle out within the extent of the turbidity curtain or hay bales. Effects from sedimentation of this area are insignificant due to the size of the work area in relation to Lake Wallula.

The construction of the work platform or the riprap that will extend into the Columbia River will not create any barriers to migration. The area of impact is expected to be less than 150 square feet within the 38,800 acre Lake Wallula.

Figure 19. Vegetation present at the end of the PPL 5.8WW.

Summary of Effects to Fish Species and Their Critical Habitat

Reclamation concludes that the proposed action is not likely to adversely affect listed fish species within the action area including; UCR spring-run Chinook, UCR steelhead, MCR steelhead, SR spring/summer Chinook, SR fall Chinook, SR Sockeye, SR steelhead since they are not likely to be utilizing this area during the proposed fall and winter work window and/or the work area will be isolated.

Reclamation concludes that the proposed action is not likely to adversely destroy or modify designated critical habitat within the action area.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. A large number of non-Federal actions associated with agriculture, aquaculture, transportation construction and rural and urban development occur in the action area.

These actions may include changes in land and water uses, including ownership and intensity, any of which could impact listed species or their habitat. Government actions are subject to political, legislative, and fiscal uncertainties. These realities, added to the geographic scope of the action area make analysis of these cumulative effects difficult.

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